

A key, check list and synonymy to the species formerly included in the genera *Caloptenopsis* I. Bolivar, 1889, and *Acorypha* Krauss, 1877

(Orth. Calliptaminae)

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INTRODUCTION.

The above named genera, together with ten others, are grouped together into the sub-family *Calliptaminae*. It is clear that the above two genera are inseparable on their original definition and a new appraisal of the contained species has been carried out to afford redefinition of generic boundaries.

Historically *Caloptenopsis* was an offshoot of the old generic taxon *Caloptenus* Burmeister, 1838, and was originally erected in 1889 as a sub-genus to include five species, *C. vittatus*, *C. nigrovariegatus*, *C. calcaratus*, *C. cicatricosus*, and *C. angusticeps*. The sub-genus was defined as having members whose posterior tibial spurs were elongate and modified, a feature not found in the other species then included under the genus *Caloptenus*. Only in 1910 was a type for the genus designated, Kirby putting forward *C. vittatus* for this role. The genus *Acorypha* was erected in 1877 by Krauss who defined the genus on pronotal shape and made his new species *A. picta* the type for the genus, thus separating this species from other members of the genus *Caloptenus*. The early separation of the genera *Caloptenopsis* and *Acorypha* from the old genus *Caloptenus* did not mean that subsequently described species were automatically put in the new genera. The names *Caloptenus*, *Calliptenus* and *Calliptamus*, were for a long time taken to be interchangeable. As late as 1902, Kirby described *Caloptenosis* species under the genus *Calliptamus* Serville (for an outline of the history of the generic name *Calliptamus* see Jago, 1963). Yet Karsch (1896) described new species

in the genus *Caloptenopsis*, his outlook being more 'modern' than Sjöstedt (1909) who described his new species *meruensis* under *Calliptamus*.

In 1929, Uvarov raised doubts as to the validity of keeping the genera *Caloptenopsis* and *Acorypha* separated at all. More species had by that time been described and the groups were better known, the pronotal characters of *Acorypha* clearly being insufficient for generic definition on its own. Ramme (1929) showed his uncertainty when he described *Acorypha* (*Caloptenopsis*) *houyi*. Uvarov synonymised *Caloptenopsis* under *Acorypha* in 1929, but chose to separate them again in 1950 when he made a useful review of the *Calliptaminae*, saying that generic definitions were still unsatisfactory and that a fuller revision was necessary.

The present revision bases its main regrouping and synonymy on the male phallic complex, which as in the revision of the related genera *Calliptamus* and *Metromerus*, appear to be very useful for species definition and for grouping species at sub-generic level.

This revision has made clear that *Acorypha gilli* Uvarov, 1929 should not be placed in the genus *Caloptenopsis* but is in fact a member of the genus *Sphodromerus* Stal. This gives another interesting connection between the fauna of north Africa, north-east Africa, and the uplands of south-west Africa. The beautiful colouring of the hind wings, while very unusual for *Caloptenopsis* is not so for the genus *Sphodromerus* where *Sp. arab*, *Sp. luteipes*, *Sp. tuareg* (all Uvarov spp.), *Sp. serapis* (Serv.), *Sp. sacer* (Giglio-Tos) all have wings with the same attractive violet pigmentation. Moreover the broad flattened penis valves are atypical for the *Acorypha-Caloptenopsis* complex but very similar to the valves seen in males of the genus *Sphodromerus*. While many *Sphodromerus* spp. are much more stocky insects, *Sp. luteipes rubripes* Uv. and *C. gilli* are very similar in build, the former being slender for the genus. The colouration of the Baluchistan specimens of *Sp. luteipes rubripes* is also very like that of *C. gilli*. The colour of the posterior tibiae is reminiscent of that in *Sp. rathjensi* Uv., and *Sp. somali* Uv. Transfer of the species *C. gilli* Uv. to *Sphodromerus* does not however change the previous synonymy with it of *Caloptenopsis violaceipennis* Ramme, 1929, which has been confirmed after an examination of the holotype from Berlin. The species should therefore be named:

***Sphodromerus gilli* (Uvarov, 1929) comb. nov.**

Synonymy: *Caloptenopsis violaceipennis* Ramme, 1929. *Mitt. zool. Mus. Berl.*, 15: 462, pl. 15, f. 1, 2 (holotype ♂. S. W. Africa, Namib, ——— 1925, (Werter). Berlin Mus.).

Besides the holotype and female paratype of *A. gilli* Uv. other material examined at the British Museum included the following material from S. W. Africa:

1 ♂, Okahandja, 19-29.III.28; 1 ♀, Zesfontein, ———; 1 ♀, Santsplatz, 1300 m., 17.XII.33, and 1 ♀, Hoffnung, 1850 m., 28.XII.33 both coll. K. Jordan; 1 ♀, Windhoek, VIII.25 (K. J. Mummbrauer).

Comment must now be made on the synonymy of the genus *Bothrocaracris* Uv., 1954 with *Acorypha* Krauss. The male genitalia of the type of *Bothrocaracris bolivari* (Uv., 1950) indicate that it is very closely related to the *nigrovariegata* complex, the male penis being a greatly elongate version of that found in *A. unicarinata* (Kr.). The vertex in *bolivari* has an apparently peculiar conformation with an anterior depression clearly divided of from a posterior narrow rectangular groove. This is however not unique as was thought when the genus was erected, since *A. recta* Uv. and others have a very similar vertex. Indeed *bolivari* only stands at one extreme of the group of species to which it belongs, having the most elongate facies and most inflated frons of the group. An examination of the type of *Caloptenopsis corallipes* Sjöstedt, 1931, shows that *B. bolivari* is a synonym so that the name falls under double synonymy.

There is no doubt that the previously separated genera *Acorypha* and *Caloptenopsis* form a very closely integrated complex. This is indicated when the phenetic difference between the 25 member species is considered, none falling outside the 16 % phenon line (for definition see Sneath and Sokal, 1962). While it is of great interest to observe that certain species fall into closely allied groups, it does not seem easy or useful to define them generically, since we are in fact dealing with forms which are so closely allied that all characters show intergradation. Even the aberrant *corallipes* (Sj.) cannot be usefully separated of when all other members of the group to which it is most closely related are considered.

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DEFINITION OF THE GENUS *Acorypha* KRAUSS, 1877.

In the light of the previous discussion on *Bothrocaracris*, it is clear that *Bothrocaracris* becomes a synonym of *Acorypha* Kr. It also becomes difficult to separate the genus *Caloptenopsis* from *Acorypha*, since neither the spur nor the pronotal characters, used in the past for separating the genera, can be used for defining a clear boundary between the two. Dirsh, 1965, uses pronotal characters in his separation of the genera. While *recta*, *ornatipes*, *pallidicornis*, *modesta*, *dipelecia*, and *picta*, fit the pronotal characters for *Acorypha* nicely, the unhelpful species *pulla*, *pipinna*, *brazzavillei*, and *nodula* do not. Moreover the 'good' *Caloptenopsis* species *unicarinata* becomes on this single criterion an *Acorypha* species. The pronotal character has to be taken in conjunction with the others and cuts across the more rational, but still inadequate definition of the two genera based on genitalia. If it is recognised that we have a complex multiple radiation of close-knit stock the problem is eliminated when we place all species in the genus *Acorypha* Krauss.

The key to the genera within the sub-family *Calliptaminae* now becomes (see Jago, 1963, p. 295):

1. Pronotum very markedly tectiform above with strong median and lateral carinae. Tegmina reduced to dorso-lateral scales 2.
- Pronotum moderately tectiform or not so, with or without strong median and lateral carinae. Tegmina variable in development 3.
2. Cerci bilobed apically with lower lobe longer than upper. Cercus angulate in apical 2/5. Cingular valve rolled inwards laterally forming a tube **Peripolus** Martinez.
- Cerci bilobed apically but with lower lobe shorter than upper. Cingular valve laminar and flat **Paracaloptenus** Martinez.
3. Penis and cingular valves simple, acutely pointed and triangular in cross section. Cercus very weak in male, uniformly tapered to apex and apically bilobed but with lower lobe lacking inwardly directed tooth **Palaciosia** C. Bolivar.
- Penis valves variably thickened or modified but never of simple form outlined above. Male cercus more powerfully developed with inwardly directed apical tooth on lower lobe 4.
4. Hind femur toothed above, hairy below, very broad. Cerci in male bilobed with lobes sub-equal, usually with upper lobe slightly longer than lower. Pronotum rugosely sculptured with almost obliterate lateral carinae. Tibial spurs unmodified **Brachy xenia** Kirby
- Hind femora never conspicuously hairy below. Lateral pronotal carinae strongly developed or showing degrees of obliteration 5.
5. Cercus in male rather weak and markedly tapered towards apex. Apex bilobed; lobes subequal. Cercus rugosely pitted on outer surface. Posterior tibial spurs showing some degree of elongation and modification. Tegmina small scale-like, lateral **Indomerus** Dirsh.
- Cercus in male never weakly developed, roughly parallel sided along most of its length, or expanded apically. Lower apical lobe or lobes much smaller than upper apical lobe. Outer surface of cercus relatively smooth. Posterior tibial spurs modified or unmodified 6.
6. Middle pair of femora with lowermost of two sulci on its outer side very weak or absent. Lateral pronotal carinae in most species very weak though in some as well developed as **Acorypha** spp. **Sphodromerus** Stal.
- Middle pair of femora with both upper and lower sulci on outer side of middle femora well developed. Upper sulcus often associated with a raised carinula. 7.
7. Lateral pronotal carinae very weak or absent. If present then broken and partly obliterated. Posterior tibiae with spurs unmodified 8.
- Lateral pronotal carinae clearly developed along all or more than half length of pronotum. Pronotal disc gibbose to smooth. 10.
8. Median pronotal carina straight in profile. Pronotal disc gibbose. Large species with distinctly lobate outer margin to hind wings, which are very broad **Sphodronotus** Uvarov.
- Median pronotal carina distinctly excavate and concave at posterior transverse sulcus when seen in profile 9.
9. Posterior margin of pronotum acute angulate (less than 90°). Lower api-

- cal tooth of male cercus falling short of tip of upper lobe by about/its own length. Lateral pronotal carinae obliterate **Bosumia** Ramme.
- Posterior margin of pronotum rounded or obtuse angulate. Lower apical tooth of male cercus falling short of tip of upper lobe by about its own length. Lateral pronotal carinae obliterate, rugose, or present but very finely developed. In some species with upper margin of posterior femur expanded in apical half and rather strongly toothed. Some species tend to have a trilobed cercus apex **Stobbea** Ramme.
10. Male cercus usually trilobed median apical lobe bearing an inwardly directed hook. Posterior tibial spurs unmodified. If cercus apex bilobed then either ratio of length to depth of cercus more than 3.54, or posterior edge of ectophallic membrane plate with an erect cylindrical knob-like sclerotisation, and/or length to depth ratio of hind femora greater than 3.3 **Calliptamus** Serville.
- Male cercus apex always bilobed. Posterior tibial spurs often modified, with one or more spurs elongate and armed with strong setae. If spurs unmodified (as in *Calliptamus*) the male cercus length to depth ratio less than 3.54 and/or length to depth ratio of posterior femora less than 3. Posterior edge of ectophallic membrane plate never with an erect knob-like cylindrical sclerotisation **Acorypha** Krauss

Discussion. The phylogenetic affinities between genera outlined above are not easy to deduce. The externally very dissimilar genera *Peripolus* and *Brachyxenia* have very similar male genitalia in which the cingular valve is tubular. In this respect if in no other, they resemble the *Acorypha* species *corallipes* and *unicarinata*. The following close relationships can however be observed:

- a) *Stobbea-Bosumia*. These two genera are closely related, with the latter forming an extreme type of *Stobbea* facies.
- b) *Sphodromerus-Sphodronotus*. *Sphodronotus* seems to represent an aberrant offshoot of the main *Sphodromerus* radiation, but several species, e. g. *Sphodromerus luteipes rubripes* Uvarov, and *Sphodromerus gilli* (Uvarov), are similar in having slimmer facies. They also seem to offer a link with the *Acorypha* group of species. Note that the tibial spine characters used for separating *Sphodromerus* from *Sphodronotus* by Uvarov (1943) do not cover several species including *luteipes*.
- c) *Calliptamus-Indomerus*. This relationship is easily seen through the *coelesyriensis* branch of the former. Both *C. coelesyriensis hissaricus* (Mischenko) and *Indomerus* have a very similar penis morphology and an ectophallic membrane plate with an erect knob-like sclerotisation.

Other more tentative relationships can be suggested. *Calliptamus* through the *coelesyriensis* side offers affinities with many of the African *Acorypha* species which lack tibial spur modifications. This is also

true of *Sphodromerus* and *Acorypha glaucopsis* but to a lesser degree. Tibial spur modification not only occurs in varying degrees in the *Acorypha* complex but also in *Indomerus*, though I do not suggest that this by itself can be taken as a measure of affinity since the modification is developed so variously in *Acorypha* and is even paralleled exactly in quite unrelated genera like *Pseudogmothela*. The penis apex in the otherwise dissimilar genera *Sphodromerus* and *Stobbea* gives another apparent indication of affinity when taken in isolation.

Analysis of affinity. An initial examination of extensive material (see data under 'material examined' sections for each species) revealed that the male genitalia were of major importance in defining species. The problem of the higher groupings was not easily tackled using the genitalia alone and it was decided that a simplified Sneath — Sokal type of analysis should be used, for which 27 parameters were chosen (excluding penis valve morphology). Only one male from each of the 26 taxa was chosen as a source for the parameters since a possible generic segregation was the major item being considered. The males used were material on loan from the British Museum, London, which had been chosen for study of phallic morphology after a careful study of the entire collection. After manipulation, the 27 parameters gave 18 ratios or measurements for analysis by the computer. Table I shows the data after adaptation from the original parameters, which are as follows:

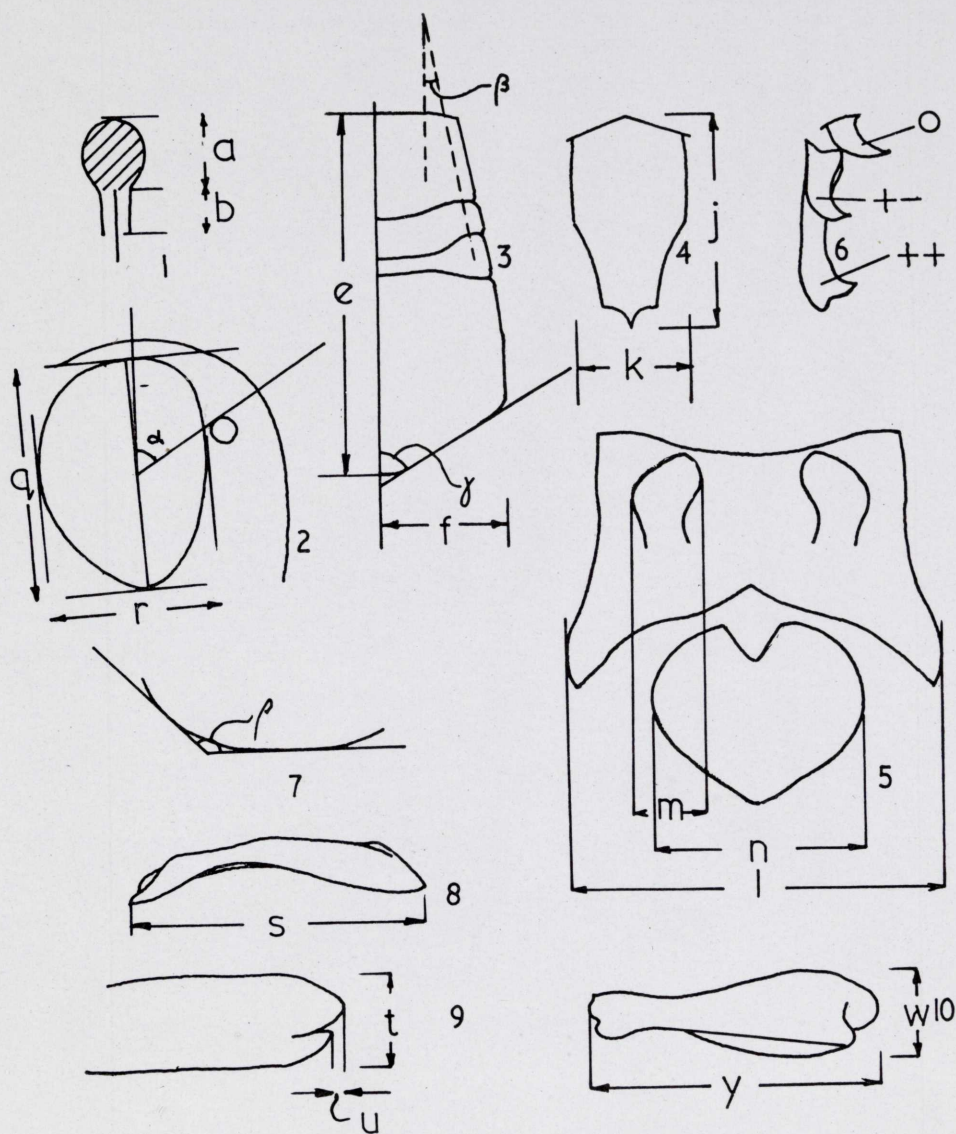
- a the fastigium verticis (fig. 1) is divided into an anterior portion, which is narrow or broad, shallow or deeply incised and a posterior portion divided along all or part of its length by a median carinula. 'a' is the length of the anterior portion as seen from directly above the vertex.
- b length of posterior portion of fastigium verticis.
- α° angle between front and posterior ends of the fastigium verticis, as measured from the mid-point of a line drawn through the longest axis of the compound eye (fig. 2).
- e an estimate of the depth of the anterior portion of the fastigium verticis, given a value from 0-9.
- d Antennal length.
- e length of pronotum along line of median dorsal carina.
- f maximum distance from mid-dorsal line of pronotum to outer edge of pronotal disc. Effectively half maximum width of pronotal disc (fig. 3).
- β° angle between line of median carina and line of maximum convergence of one lateral margin of pronotal disc (fig. 3).
- γ° angle between line of median carina and one side of posterior pronotal hind margin (fig. 3).

- g shape of pronotal tubercle. A figure is given between 0 and 9 indicating the degree of apical inflation, i.e. 0 tapered, 5 parallel sided, 9 bulbous at apex.
- h a measure of lateral expansion of prosternal tubercle as seen in transverse section, i.e. 0 represents a circular cross section and 9 an ovoid or laterally produced cross section.
- j length of supra-anal plate (fig. 4).
- k width of supra-anal plate (fig. 4).
- l width of epiphallic plate (fig. 5).
- m width of epiphallic tooth or ancora (fig. 5).
- n width of ectophallic membrane plate (fig. 5) (for explanation of terms see Jago, 1963).
- p development of posterior tibial spurs. Each of the four spurs is given an arbitrary value, i.e. ++, 5; +, 2.5; ·, 1.0; not modified, 0. The values are then added to give a total measure of spur modification (fig. 6).
- q length of longest axis of compound eye (fig. 2).
- r maximum width of compound eye (fig. 2).
- ρ° angle of curvature of ectophallic membrane plate measured along its mid-line (fig. 7).
- s length of male cercus (fig. 8).
- t depth of cercus at apex (fig. 9).
- u separation of tip of lowermost tooth bearing lobe from apex of cercus (fig. 9).
- v length of posterior femur (fig. 10).
- w maximum depth of posterior femur (fig. 10).

It will be noted that tegminal length has not been included. It might be argued that this would be an indicator of phylogenetic affinity since reduction in wing length might indicate the ability of the group to adapt to moist and cold upland areas, a situation which appears to induce brachypterousness. The two most brachypterous species in the genus however (*hemiptera* and *nodula*) come from quite separate species groups (where grouping is based on male phallic characters), while *johnstoni* and *glaucopsis* also show a trend toward a lesser degree of brachypterism, indicating that the quality is equally developed between clearly separate species groups. To include this character would only obscure other differences.

All the above measurements, except those of the epiphallus and ectophallic membrane plate, were carried out at the same degree of magnification under a binocular microscope and camera lucida. The units of measure used for the epiphallus and ectophallic membrane plate are not therefore comparable with the rest. Angle β was difficult to measure in those species where there is a marked angular change of direction in the lateral pronotal carinae between transverse sulci or between most

posterior transverse sulcus and posterior edge of pronotum. In such cases, where the pronotum has a more marked appearance of tapering anteriorly, the line was drawn which gave the best match with the



Figs. 1-10.—Anatomical features of males referred to in text (pp. 403-404) and in table: 1) fastigium verticis; 2) lateral aspect of head from right side showing compound eye and ocellus; 3) dorsal aspect of right half of pronotal disc.; 4) supra-anal plate; 5) epiphallus and ectophallic membrane plate; 6) posterior tibial spurs; 7) diagrammatic representation of lateral elevation of ectophallic membrane plate; 8) dorsal aspect of left cercus; 9) tip of left cercus showing apical lobes viewed normal to plane of upper lobe; 10) inner aspect of left posterior femur (diagrammatic).

TABLE 1.

Species or subspecies	a/b	a	c	d/e	β	γ	e/f	g	h	j/k	l/m	l/n	p	q/r	ρ	s/t	t/u	v/w
1. <i>glaucopsis</i>	1.00	66	9	1.88	10	54	2.71	5	0	1.76	5.45	2.58	0	1.44	98	3.28	12.0	2.71
2. <i>pulla</i>	3.75	74	9	2.02	11	54	2.86	5	9	1.72	7.20	2.40	0	1.29	99	2.96	3.86	2.73
3. <i>clara</i>	1.06	69	9	1.73	16	50	3.05	5	0	2.03	7.00	1.33	2.5	1.60	105	4.10	2.29	2.91
4. <i>insignis</i>	1.14	58	9	1.84	16	46	2.78	5	0	1.98	5.50	1.69	2.5	1.30	118	3.74	2.44	2.91
5. <i>picta</i>	3.8	70	9	2.0	21	50	2.93	5	9	1.74	6.00	1.38	1	1.25	164	3.17	3.63	2.72
6. <i>ferrifer</i>	1.45	61	1	2.10	13	57	2.88	9	0	2.07	7.74	1.80	6	1.42	115	2.52	7.67	3.00
7. <i>hemiptera</i>	1.80	61	1	1.92	4.5	57	3.16	9	0	1.88	5.40	3.87	5	1.37	134	3.18	5.50	3.11
8. <i>laticosta</i>	2.13	68	1	2.0	19	53	2.66	9	0	2.34	6.85	4.00	5	1.31	120	2.70	8.6	3.47
9. <i>j. johnstoni</i>	1.67	60	1	2.13	11	59	2.80	9	9	1.88	5.60	3.11	5	1.37	105	3.33	3.08	3.22
10. <i>j. oresbia</i>	1.89	65	1	1.66	7.5	56	3.25	9	0	1.96	5.78	2.6	7.5	1.41	113	3.10	10.0	3.39
11. <i>karschi</i>	3.0	63	1	—	13	50	2.87	9	0	1.96	7.0	1.96	5	1.38	123	3.02	4.5	3.89
12. <i>bimaculata</i>	2.21	69	9	1.99	10	54	2.57	0	9	1.95	7.8	1.34	0	1.31	143	3.24	2.42	3.59
13. <i>onerosa</i>	1.80	64	1	2.30	10	53	2.96	5	0	1.93	3.84	1.31	6	1.31	90	3.40	3.64	2.87
14. <i>ornatipes</i>	3.5	67	9	1.37	13	47	2.86	9	9	1.79	6.30	2.75	1	1.25	123	3.52	3.13	2.99
15. <i>pallidicornis</i>	5.28	68	9	—	25	52	2.45	0	9	1.95	6.80	1.31	1	1.31	104	2.73	4.13	2.63
16. <i>decisa</i>	1.69	58	5	—	9	56	2.85	5	0	1.79	6.00	2.34	6	1.41	104	4.16	2.37	4.42
17. <i>nodula</i>	3.56	83	9	—	11	50	2.77	0	9	1.61	8.45	2.45	0	1.26	139	3.43	4.20	2.03
18. <i>braszavillei</i>	1.44	80	9	2.40	22	56	2.53	0	9	2.06	5.33	1.14	2.5	1.29	105	2.77	3.78	2.79
19. <i>modesta</i>	1.87	69	9	2.35	21	42	2.84	0	9	1.59	8.75	3.11	7.5	1.29	103	3.12	2.78	2.86
20. <i>dipelecia</i>	2.06	79	9	2.68	26	45	2.62	5	0	1.66	6.38	1.85	7.5	1.37	93	3.35	2.30	2.77
21. <i>pipinna</i>	3.0	89	9	2.97	6.5	56	2.61	9	9	1.79	4.47	1.27	0	1.30	63	3.03	3.63	2.68
22. <i>unicarinata</i>	1.78	77	1	2.39	22.5	49	2.23	5	9	1.50	6.82	3.05	7.5	1.25	118	3.24	1.54	2.73
23. <i>nigrovariegata</i>	0.96	68	1	1.94	17	50	2.68	5	9	1.92	2.37	1.02	7.5	1.38	143	3.36	2.06	3.24
24. <i>recta</i>	1.17	47	5	1.82	10	44	2.88	9	9	1.67	5.17	1.27	5	1.33	105	2.57	5.83	3.11
25. <i>corallipes</i>	0.93	76	9	—	18	52	2.93	0	0	1.80	6.94	3.55	7.5	1.41	125	3.54	3.00	3.94
26. <i>divisa</i>	1.25	72	9	1.82	22	51	2.43	5	9	2.15	5.47	1.49	5	1.39	136	2.75	5.00	2.64

Table 1.—Data used in computation of dendrogram fig. 11.

TABLE 2.

Number	Name	Comments on Penis Structure	Tibial Spur Specialisation
25	<i>corallipes</i>	Extremely elongate penis valves. Cingular valve tubular	7.5
22	<i>unicarinata</i>	Not so elongate. Cingular valve like 25.	7.5
23	<i>nigrovariegata</i>	Penis narrow, elongate, but lateral penis valves protruding and flattened. Cingular valve shorter.	7.5
8	<i>laticosta</i>	Narrow. Cingular valve rather shorter than penis valves.	5
7	<i>hemiptera</i>	As 8.	5
9	<i>j. johnstoni</i>	Narrow. Cingular valve shorter than penis valves. Tip of penis growing lateral flanges.	5
10	<i>j. oresbia</i>	Like 9, but penis valves broader and near to 6.	7.5
6	<i>ferrifer</i>	Penis fairly narrow and elongate. Reduced cingular valve.	6
24	<i>recta</i>	Elongate valves reminiscent of 23.	5
26	<i>divisa</i>	Like a shortened version of 23.	5
13	<i>onerosa</i>	Penis valves and cingular valve flattened apically and laterally expanded.	6
11	<i>karschi</i>	Related to 22 and 23 but broader.	5
3	<i>ciara</i>	Like 11.	2.5

TABLE 2 (Continued)

4	<i>insignis</i>	Like 11.	2.5
20	<i>dipelecia</i>	Very small cingular valve. Small thick penis valves.	7.5
19	<i>modesta</i>	As 20.	7.5
18	<i>brazzavillei</i>	As 20, but penis valves more laterally expanded.	2.5
21	<i>pipinna</i>	A very small version of 15.	0
15	<i>pallidicornis</i>	Cingular valve sclerotised and expanded. Penis valves thick and auricular.	1
12	<i>bimaculata</i>	Like 15.	0
5	<i>picta</i>	Like 15.	1
2	<i>pulla</i>	Like 15 but laterally expanded.	0
17	<i>nodula</i>	As 2.	0
14	<i>ornatipes</i>	As 2 but greatly expanded laterally.	1
1	<i>glaucopsis</i>	As 2, but slightly more expanded.	0
16	<i>decisa</i>	As 15 but penis valves less auricular.	6

Table 2.—Species in genus *Acorypha* showing relationship indicated by male aedeagus and tibial spur specialisation.

most sharply incurved section of the carina. When *j* was being measured, difficulty was encountered with *unicarinata* which has a median anterior tooth fitting deeply into a recess on the posterior margin of abdominal tergite 10. In this case the recess on the tergite was ignored and the line of the posterior edge of the tergite on each side produced inwards. The length *j* was then measured from the point where these two lines met the mid-dorsal line of the supra-anal plate.

The posterior tibial spurs are variously elongated and produced near the apex (fig. 6), apparently as an adaptation to leaping on loose gravel surfaces. One or more spurs may be so modified. The modification starts with a thickening and elongation of the spur bristles so that these alone increase the gripping efficiency of the tibia. Such a modification is never noticeable in *Calliptamus* for example. In older specimens late in the adult life the bristles are often seen to have been

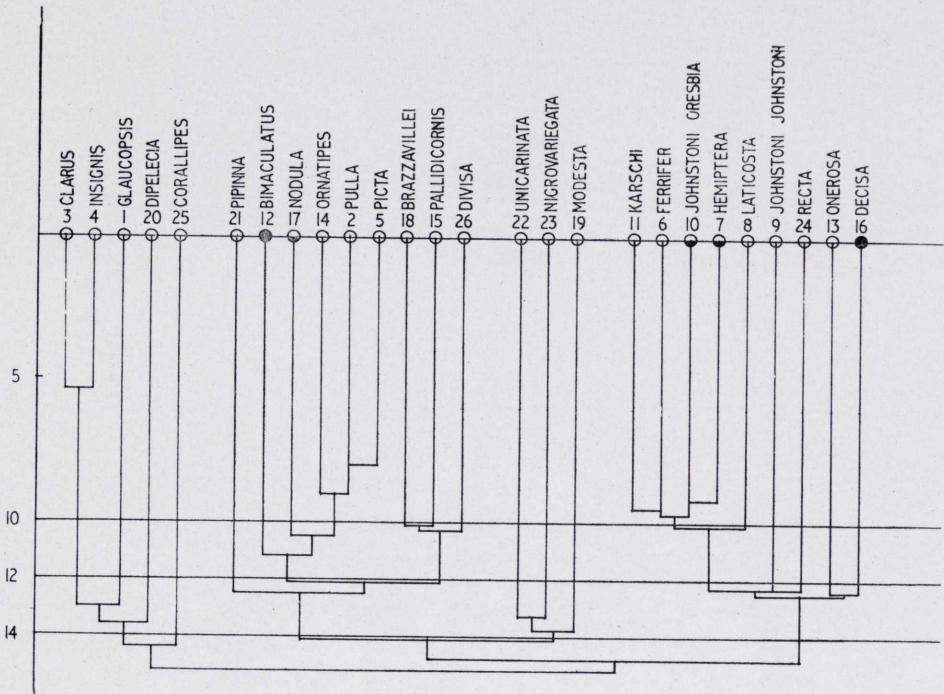


Fig. 11.—Dendrogram showing phenetic affinity of the taxa (1-26). Horizontal lines drawn at 10, 12, and 14 % levels of phenetic differences (for explanation see p. 410).

worn away. To counteract this, and also in response to adaptation to even looser substrates, many species have developed elongated spurs.

A glance at table 1 shows the 18 columns of data for the 25 taxa. Both subspecies of *johnstoni* were included for interest. The maximum value was now taken in each column and the other figures related to it as percentages. It was now possible to compare the development of all the characters between every possible combination of species pairs. The labour involved in this exercise was greatly eased by using the Tanzanian Government computer for which a Fortran programme was written by Professor E. Phythian, head of the mathematics institute at

University College, Dar es Salaam. I am greatly indebted to him for the considerable time and effort he put into making the exercise a success. The computer summed every possible taxon pair comparison for all 18 characters and gave an average value. This was a factor which can be termed the coefficient of difference, the mean percentage difference between each pair of taxa. The programme arranged these coefficients in order of increasing magnitude, and subdivided the list into steps of 5 %, all values lying in the range 0-5 % clearly being most closely similar on the data chosen. The results can be tabulated in the form of a dendrogram (fig. 11). Horizontal lines drawn at the 5, 12, and 14 % levels indicate arbitrarily chosen levels of decreasing similarity or increasing coefficient of difference.

INTERPRETATION OF RESULTS.

1. The complete set of taxa appear within the narrow range of 0-15.2 %. The group is thus extremely close-knit phenetically.
2. By comparison with groupings based on male genitalia morphology, it seems that grouping above the 12 % phenon are indicative of closely related species groups. Below this level however, certain species are 'floating', since at this level the phenetic resemblance need not be very close to bring them together. Thus on grounds of male penis morphology, 25 *corallipes*, belongs to the group 11-16 on the right hand side of the diagram, and is not really closely related to species 20, *dipelecia* with which the computer indicated affinity at the 14.4 % level. Such species peripheral to the main groups, thus come to lie together. While *clara* and *insignis* are very close to each other, they are not necessarily very closely related to *glauropsis* on grounds of penis structure. They seem rather to lie between the 21-26 group and the 11-16 group along with 22-19. Species 20, *dipelecia*, is definitely very closely related to 19 (see map fig. 12 and figs. 106, 107, pp. 411 and 420) both on grounds of their mutual zoogeographical relationship and penis morphology. It is however of great interest that an analysis using extra-aedeagal characters so closely parallels that using penis morphology alone, and also indicates some interesting relationships within the group themselves.
3. The species may be placed in series based on penis morphology.

In table 2 forms which are very similar are bracketed together. While their penis valve morphology is variable, 16, 13, 11, 3, 4, and 25, 22, 23, 8, 7, 9, 10, 6, 24, 26, are all related in having distinctly mo-

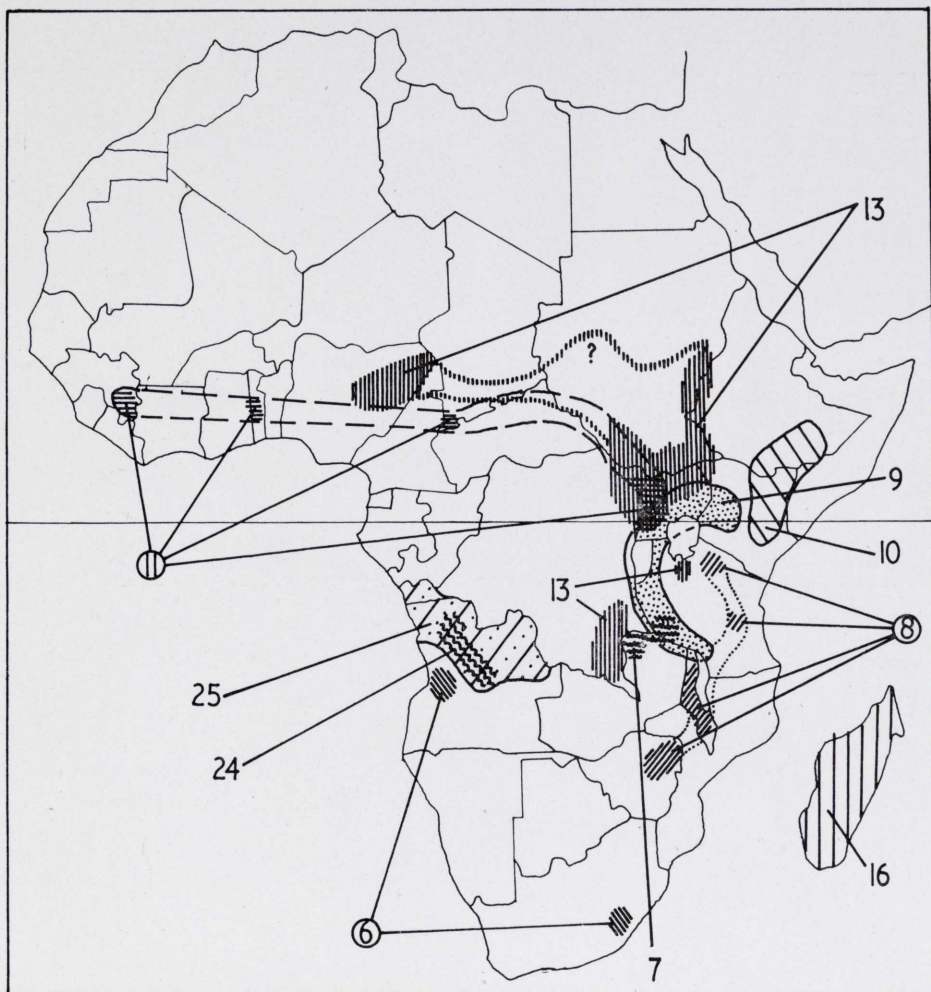


Fig. 12.—Distribution map. Numbers refer to species numbers in figure 11: 6) *ferrifer*; 7) *hemiptera*; 8) *laticosta*; 9) *johnstoni johnstoni*; 10) *johnstoni oressibia*; 11) *karschi*; 13) *onerosa*; 16) *decisa*; 24) *recta*; 25) *corallipes*.

dified posterior tibial spurs. A glance at the dendrogram shows that those species fall into the right hand group, or in the case of 25, 22, 23, 3, and 4, are peripheral, united at a relatively low level of similarity. Likewise 21, 18, 15, 12, 5, 2, 17, 14, and 1, are united in the table both on penis morphology and the possession of weakly modified spurs, a glance at the dendrogram showing them to be peripheral aberrant

members of the main left hand group, *brazzavillei* (15), *modesta* (19) and *dipelecia* (20) lying outside the group altogether. Their position as 'outsiders' is further reflected in their zoogeographical relationship (fig. 13).

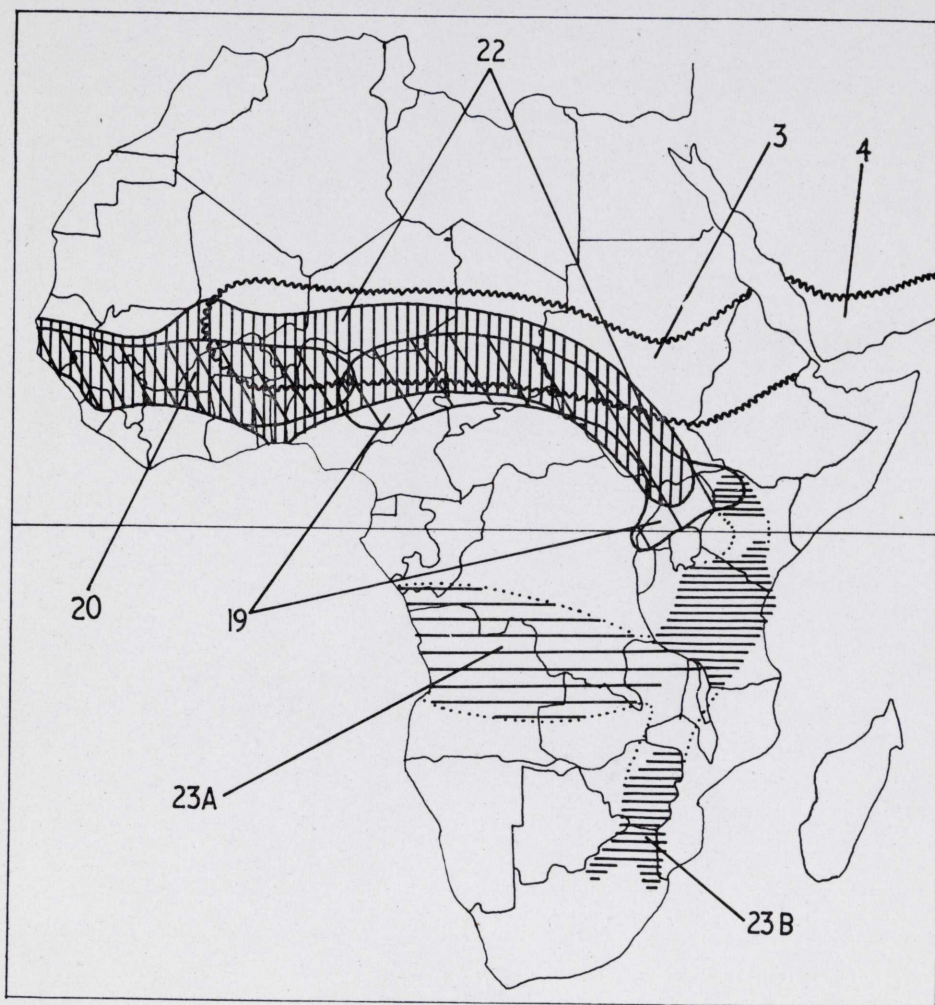


Fig. 13.—Distribution map. Numbers refer to species numbers in figure 11: 3) *clara*; 4) *insignis*; 19) *modesta*; 20) *dipelecia*; 22) *unicarinata*; 23A) *nigrovariegata*; 23B) *nigrovariegata tibialis*.

The dendrogram shows the island species (solid circles) and montane brachypterous species (solid semicircles). Judging by phenetic relationship and penis morphology, *bimaculata* and *nodula* would seem to have been derived from *picta*. Species 16, *decisa*, occurs in Madagascar, and seems to be allied to *onerosa*. One might speculate that

it arose from the same general group as *onerosa*, and that the genitalia have remained nearer to the *pulla-picta* group from which both have di-

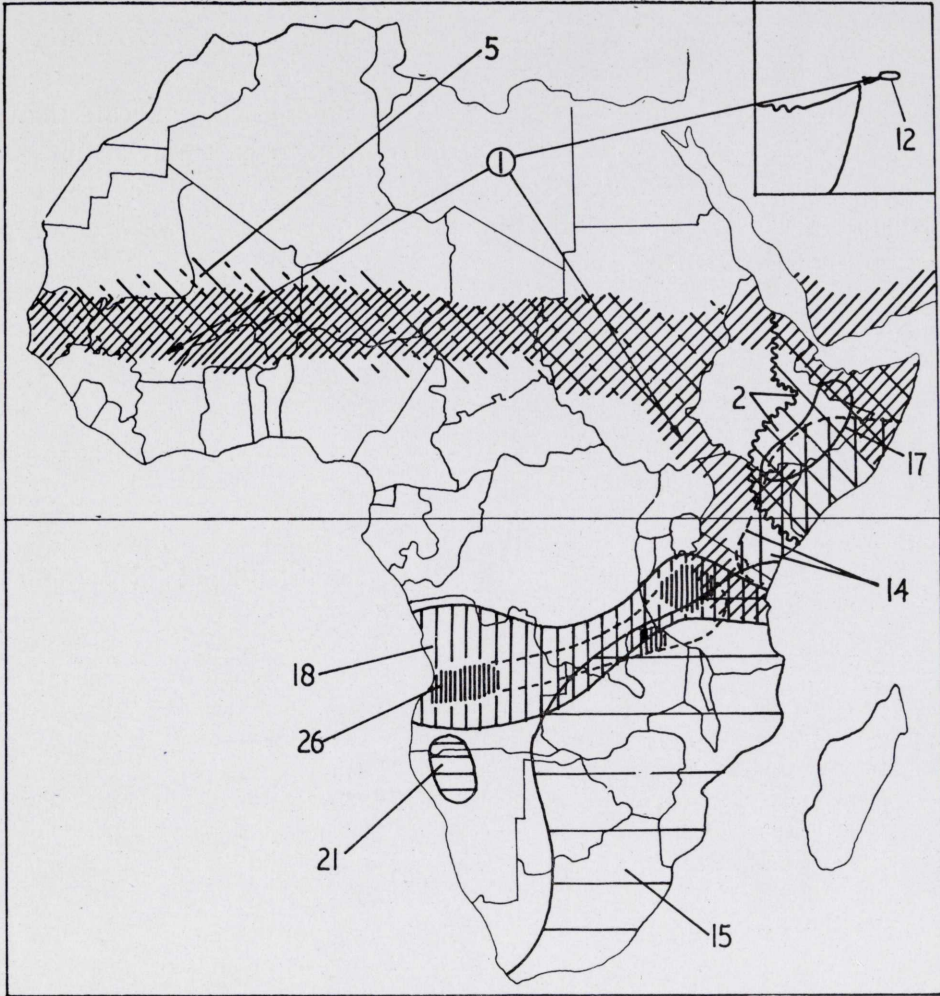


Fig. 14.—Distribution map. Numbers refer to species numbers in figure 11: 1) *glaucopsis*; 2) *pulla* (wide diagonal shading and wavy border); 5) *picta* (dashed and entire diagonal shading); 12) *bimaculata*; 14) *ornatipes* (wide vertical shading); 15) *pallidicornis* (wide horizontal shading); 17) *nodula* (small area marked by closed line in Ethiopia and Somalia); 18) *brazzavillei* (narrow vertical shading); 21) *pipinna*; 26) *divisa* (three 'isolated' areas linked by broken line and represented by very narrow vertical shading).

verged. It is of interest that *johnstoni oresbia* and *ferrifer* are so closely allied in the dendrogram. Both here and in penis morphology one would deduce an origin for them from *johnstoni johnstoni* stock

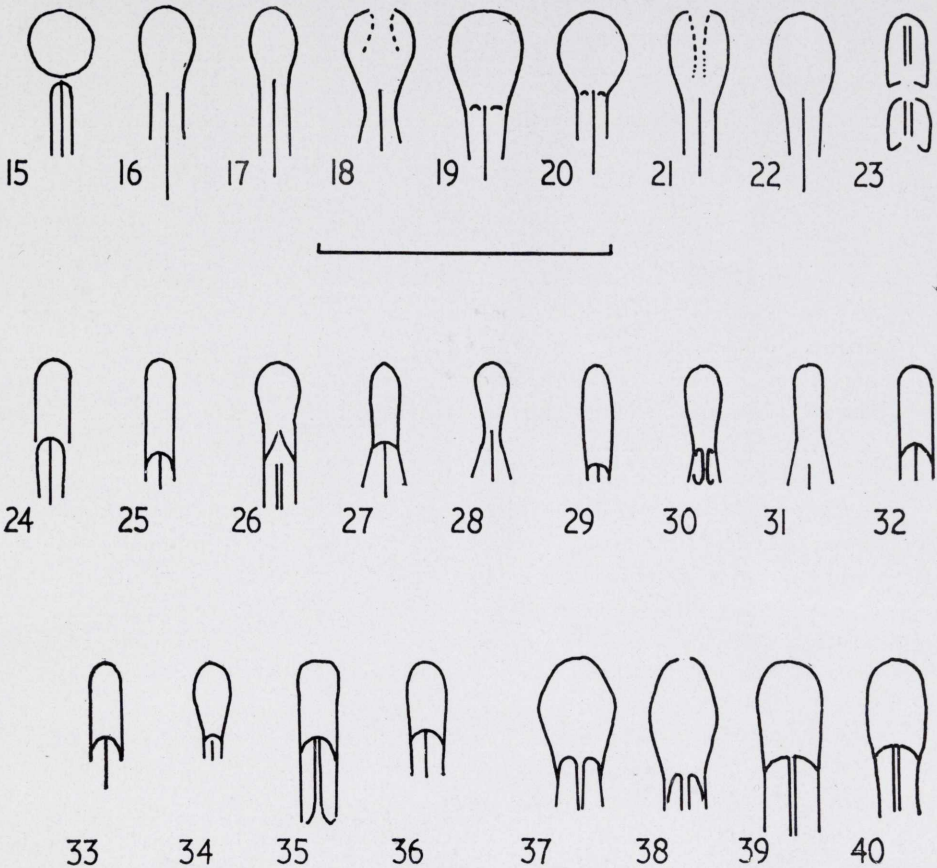
on both sides of the equator. *A. hemiptera* seems to be close to *laticosta*, both phenetically and geographically (fig. 12, spp. 1 and 8).

A. corallipes (fig. 12) and the right group of the dendrogam include the most disjunct species zoogeographically. Not only have many of the species very small areas of distribution, but all except *onerosa* in its northern distribution are associated with upland plateau areas or extreme montane savannah conditions. This would seem to indicate that they may have had a wider area of distribution in past pluvial times, and that much of the present speciation may be due to relatively recent isolation. This is most clearly indicated in *johnstoni johnstoni* and its upland derivative *oresbia*.

KEY TO SPECIES IN THE GENUS *Acorypha* KRAUSS.

1. Vertex with fastigium extending as a narrow, often deeply incised groove, onto upper part of frontal ridge and almost to level of upper edge of antennal sockets. Usually without modified spur or spurs on posterior tibiae, or with these little modified, but if spurs modified then fronto-vertical groove shallowly incised (figs. 23 and 25-35) and parallel sided, or of form shown in figs. 26 and 27 with deep narrow anterior groove 2.
- Vertex with fastigium verticis developed as a more dorsally orientated impression between eyes, or as a narrow posterior sagittal groove and an irregular dorso-anteriorly orientated ovoid area divided from it by a transverse raised portion, or with posterior groove almost obsolete and anterior ovoid depression boldly impressed. Usually with spur or spurs of posterior tibia modified and elongated (figs. 15-22, 24, 36-40). Spurs hardly modified in *clara* or *insignis*, but (figs. 39 and 40) fastigium verticis with an obvious orientation dorsad, a/b ratio near unity, and anterior depression not an elongated narrow groove 13.
2. Tegmina greatly abbreviated, their tips not surpassing middle of folded posterior femora **nodula** (Giglio-Tos).
- Tegmina normally developed as organs of flight 3.
3. Outermost of inner pair of posterior tibial spurs greatly elongated and modified; innermost of outer pair sometimes so 4.
- Spurs mentioned above of normal length and conformation or hardly modified 6.
4. Innermost of outer pair of posterior tibial spurs hardly modified or elongated. Penis valves elongated (fig. 104), divergent apically. Cingular valve flat and membranous. Hind wings colourless **recta** Uvarov.
- Innermost spur of outer pair on posterior tibiae clearly elongated and modified (see values of 'p', table 1). Penis valves short (fig. 106, 107) ... 5.
5. Male penis valves with distinct concavity on posterior surface, their outer margins diverging towards tip (fig. 107). Epiphallus with broad upwardly

orientated ancorae. Dorsal ectophallic membrane plate broad, being as wide epiphallus. Not found east of eastern Nigeria. Range from Nigeria to Senegal **dipelecia** Jago.
— Male penis valves without any trace of concavity on posterior surface,



Figs. 15-40).—Fastigium verticis of: 15) *corallipes*; 16) *unicarinata*; 17) *nigroviriegata*; 18) *laticosta*; 19) *hemiptera*; 20) *johnstoni johnstoni*; 21) *johnstoni oresbia*; 22) *ferrifer*; 23) *recta*; 24) *divisa*; 25) *pipinna*; 26) *dipelecia*; 27) *modesta*; 28) *brazzavillei*; 29) *pallidicornis*; 30) *bimaculata*; 31) *picta*; 32) *pulla*; 33) *nodula*; 34) *ornatipes*; 35) *glaucoptis*; 36) *decisa*; 37) *onerosa*; 38) *karschi*; 39) *clara*; 40) *insignis* (scale represents 3 mm.).

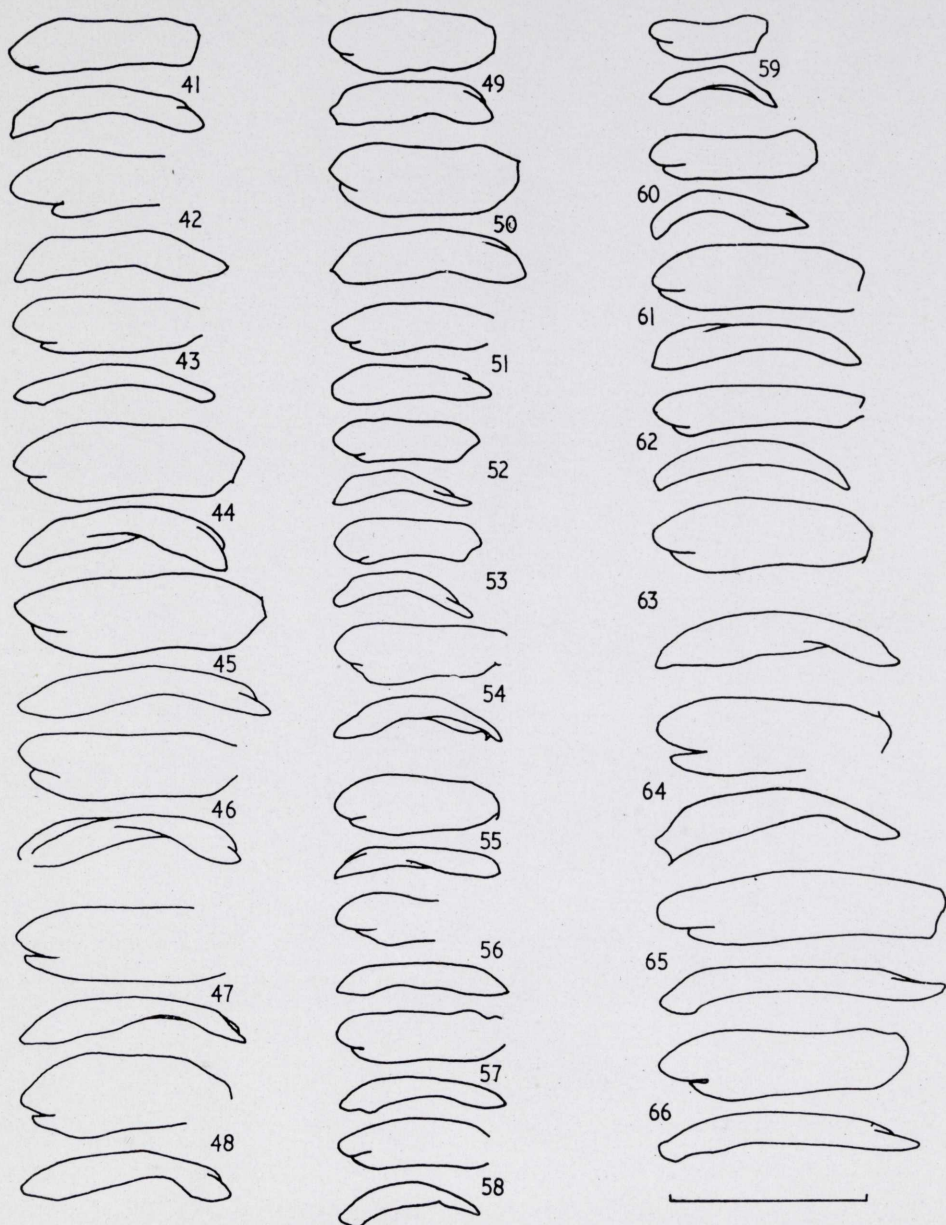
their outer margins converging upwards (fig. 106). Epiphallus with small inwardly orientated ancorae. Dorsal ectophallic membrane plate very narrow and small. Not found west of eastern Nigeria **modesta** Uvarov.
6. Hind wings colourless 7.
— Hind wings pink, at least basally 11.
7. Inner side of posterior femora yellow or ochrous body colour Antennae distinctly flattened, last segments in ♀ being tapered and acutely pointed,

*

- last segment in ♂ flattened and wedge shaped **brazzavillei** Sjöstedt.
- Inner side of posterior femora pink and/or with a basal black spot or spots 8.
8. Inner side of posterior femora orange or orange-red without black markings 9.
- Inner side of posterior femora with black spots or markings 10.
9. Posterior tibiae yellow. Inner area of posterior femora without black markings of any kind, it and lower inner area suffused with pale orange-red. Prosternal tubercle decidedly transverse and tapered **picta** Krauss.
- Posterior tibiae dull pale orange; inner side posterior femora, plus its lower inner area and often lower outer area, deep to pale orange. Lower outer area in ♂♂ almost invariably with dark brown or maroon stripe which may cover whole area. Prosternal tubercle weakly transverse and tapered with a rounded tip **ornatipes** Uvarov.
10. Length of pronotum to width of disc at widest less than 1.30. Prosternal tubercle transverse, slightly tapered (see e/f ratio in table 1) **pallidicornis** Stål.
- Length of pronotum to width of disc at widest point more than 1.30. Prosternal tubercle transverse but slightly indented at tip and grooved posteriorly (see e/f ratio table 1) **pipinna** sp. nov.
11. Length to depth of posterior femora greater than 2.8. Posterior tibiae pale yellow. Inner side of posterior femur solid black. Lower inner femoral carina also black **bimaculata** Krauss.
- Length to depth of posterior femora less than 2.8 12.
12. Small insects (body length ♂ arr. 15-18 mm., ♀ arr. 23 mm.). Lower inner area of posterior femora pink. Inner area pink, with or without black spots, which are always two in number if present and separate or joined. Posterior tibiae pink. Prosternal tubercle tapered **pulla** Uvarov.
(Limited distribution in N. Kenya, Somalia, and Ethiopia.)
- Larger insects (body length ♂ 17-22 mm., ♀ 26-33 mm.). If approaching *pulla* in size then posterior tibiae and inner side of femora yellow (with or without separate spots of black in inner area). Posterior tibiae yellow, flushed with red or orange. If posterior tibiae red, then lower inner area yellow, crimson, red, or pink. If latter pink then inner area darker red, never of same pink colour. Prosternal tubercle slightly transverse and gently tapered. Widespread distribution from West Africa to India **glaucopsis** (Walker).
13. Tegmina not reaching to middle of posterior femora when latter in folded position. Posterior tibiae pink **hemiptera** Uvarov.
- Wings normally developed as organs of flight 14.
14. Anterior part of frons inflated on a level with antennal sockets. Posterior tibiae dull pink. Posterior margin of pronotum smoothly rounded in outline. Fastigium verticis developed as a very clearly defined anterior ovoid depression separated from a deeply incised posterior longitudinal groove. Male

cercus very elongate, length to maximum depth 3.5. Hind wings colourless **corallipes** Sjostedt.

— Anterior part of frons not noticeably inflated on a level with antennal

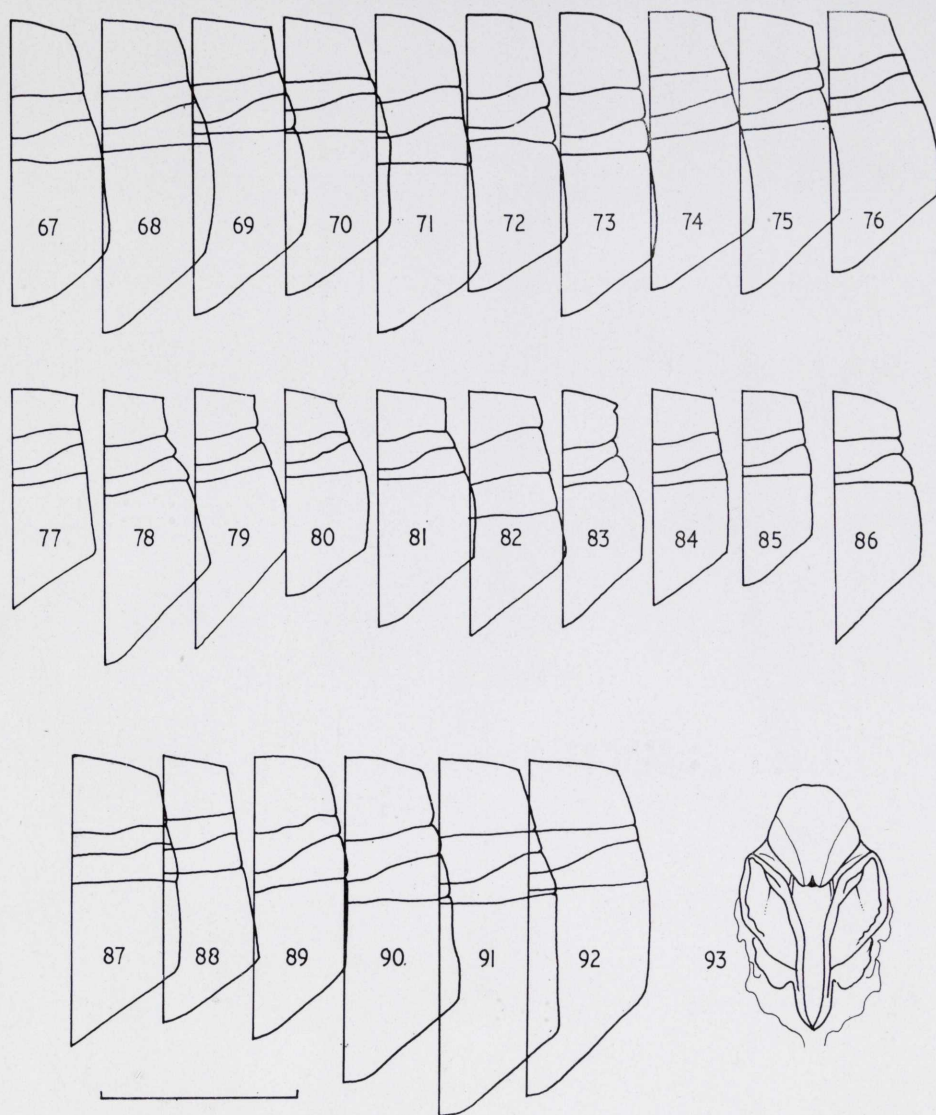


Figs. 41-66.—Male right cerci from outer and upper sides: 41) *corallipes*; 42) *unicarinata*; 43) *nigrovariegata*; 44) *laticosta*; 45) *hemiptera*; 46) *johnstoni johnstoni*; 47) *johnstoni oresbia*; 48) *ferrifer*; 49) *recta*; 50) *divisa*; 51) *pipinna*; 52) *dipelecia*; 53) *modesta*; 54) *brazzavillei*; 55) *pallidicornis*; 56) *bimaculata*; 57) *picta*; 58) *pulla*; 59) *nodula*; 60) *ornatipes*; 61) *glaucopsis*; 62) *decisa*; 63) *onerosa*; 64) *karschi*; 65) *clara*; 66) *insignis* (scale represents 3 mm.).

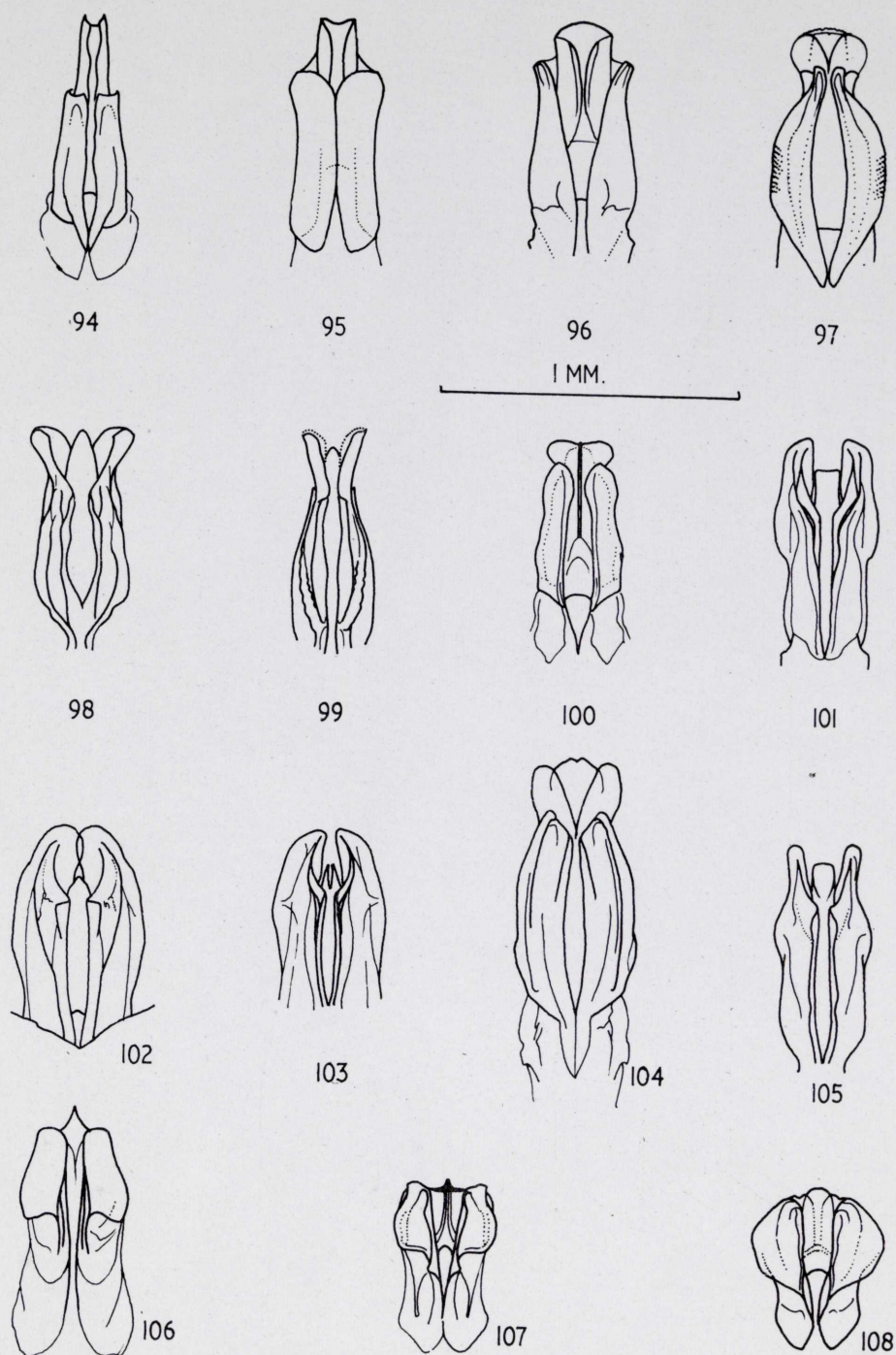
- sockets. Male cercus usually shorter and deeper, s/t ratio usually less than 3.4. If this ratio greater than 3.5, then length to depth of posterior femora more than 3, or posterior tibial spurs unmodified 15.
15. Lateral pronotal carinae either straight and converging forwards uniformly, or gently arcuate and outcurved, but markedly convergent forwards even posterior to 4th. transverse sulcus (figs. 76 and 88) 16.
- Lateral pronotal carinae a distinct angular change of direction about level of 4th. transverse sulcus, not smoothly arcuate, posterior to this being parallel, very gently convergent forwards or even slightly convergent backwards (in some *onerosa*). If lateral carinae almost straight, then fastigium verticis not forming a concave depression on level with or anterior to front margin of compound eyes, but convex or flat in this region (figs. 70, 72, 73, 74, 89, 90). 17.
16. Length of pronotum to maximum width across disc about 1.2. Fastigium verticis distinctly divided into an anterior ovoid depression and a posterior rectangular depression which is divided into two grooves medially by a narrow ridge. Male cercus about 2.75 times as long as deep ... *divisa* Uvarov. (Tanzania, Zambia, and Angola.)
- Length of pronotum to maximum width across disc about 1.4. Fastigium verticis consisting mainly of a concave ovoid depression with mere traces posteriorly of another impressed area defined by 3 very short longitudinal ridges. Male cercus length to depth ratio about 4 *decisa* Walker. (Madagascar only.)
17. Females from Madagascar *decisa* Walker.
- Insects of both sexes with an extra-Malagasy distribution 18.
18. Inner area of posterior femora pink, red, or orange 23.
- Inner area of posterior femora pale to deep yellow, with or without black markings 19.
19. Inner side of posterior femora almost filled with black pigment. Posterior tibiae always yellow, often with blackish annulus about 3/5 of way from distal end. Male supra-anal plate with unique median anterior tooth directed anteriorly into a depression in last abdominal tergite *unicarinata* Krauss.
- Inner side of posterior femora either immaculate or with only small black markings 20.
20. Fastigium verticis above upper ocelli deeply impressed forming an elongate oval depression. Posterior femora immaculate internally, yellow. Posterior tibiae always yellow 21.
- Fastigium verticis above upper ocelli very shallowly concave, flat, or even convex 22.
21. Distribution in Africa only. Male cerci elongate, length to depth ratio about 4. Spots on apical half of tegmina randomly distributed. Male epiphallallic plate as deep as wide. Posterior tip of ectophallic membrane plate very elongate, pointed, and upturned. Penis valves as in fig. 121 *clara* Walker.
- Distribution outside Africa. Male cerci not as elongate, about 3½ times

as long as deep. Spots on apical half of tegmina orientated in transverse lines. Epiphallus of ♂ distinctly wider than deep. Ectophallic membrane plate with gently upcurved and only slightly pointed posterior tip. Penis valves as in fig. 122 *insignis* Walker.

22. Anterior ovoid depression of fastigium verticis smooth 23.

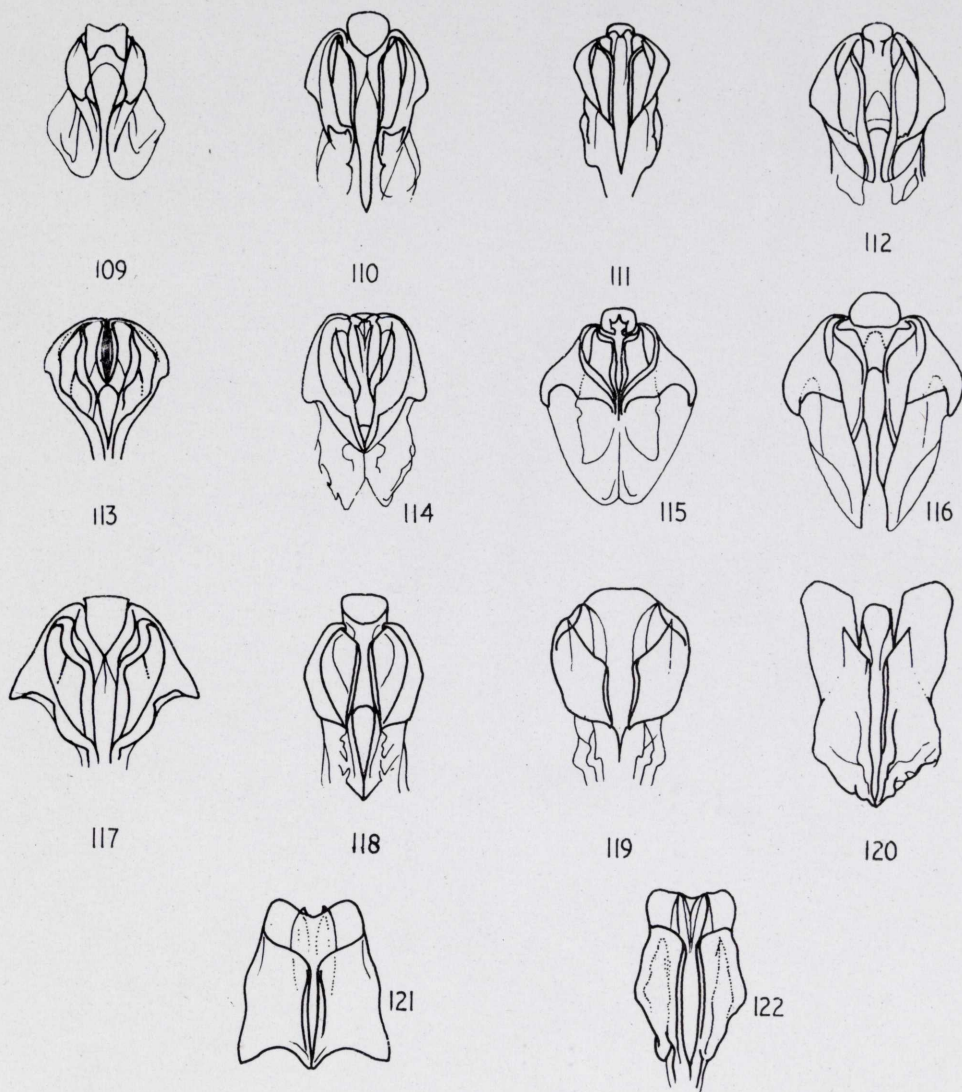


Figs. 67-92.—Dorsal aspect right side of pronotal disc (scale represents 3 mm.): 67) *corallipes*; 68) *unicarinata*; 69) *nigrovariegata*; 70) *laticosta*; 71) *hemiptera*; 72) *johnstoni johnstoni*; 73) *johnstoni oresbia*; 74) *ferrifer*; 75) *recta*; 76) *divisa*; 77) *pipinna*; 78) *dipelecia*; 79) *modesta*; 80) *brazzavillei*; 81) *pallidicornis*; 82) *bimaculata*; 83) *picta*; 84) *pulla*; 85) *reducta*; 86) *ornatipes*; 87) *glaucoptis*; 88) *decisa*; 89) *onerosa*; 90) *karschi*; 91) *clara*; 92) *insignis*; 93) apex of penis complex *Sphodromerus gilli* (for scale see figs. 94-108).



Figs. 94-108—Penis valve apices in: 94) *corallipes*; 95) *unicarinata*; 96) *nigrovariegata nigrovariegata*; 97) *nigrovariegata tibialis*; 98) *laticosta*; 99) *hemiptera*; 100) *divisa*; 101) *johnstoni johnstoni* (Uganda); 102) *johnstoni oresbia*; 103) *ferrifer*; 104) *recta*; 105) *johnstoni johnstoni* (Kenya); 106) *modesta*; 107) *dipelecia*; 108) *brazzavillei*.

- Anterior ovoid depression of fastigium verticis with coarse punctures or divided into two by longitudinal ridge 26.
23. Anterior ovoid depression of fastigium verticis same width (♂ of western



Figs. 109-122.—Penis valve apices in: 109) *pipinna*; 110) *pallidicornis*; 111) *bi-maculata*; 112) *picta*; 113) *pulla*; 114) *nodula*; 115) *ornatipes* (Somalia); 116) *ornatipes* (Tanzania); 117) *glaucopsis*; 118) *decisa*; 119) *onerosa*; 120) *karschi*; 121) *clara*; 122) *insignis*.

nominate subspecies and females of both subspecies) or narrower than first antennal segment (♂ eastern subsp. *nigrovariegata tibialis* (Kirby))
..... ***nigrovariegata* I. Bolívar.**

- Anterior ovoid depression $1 \frac{1}{2}$ to 2 times width of first antennal segment 24.
- 24. Females **onerosa** Uvarov.
- Males 25.
- 25. Narrowest part of frontal ridge just below level of most anterior part of fastigium verticis. Frons below lower ocellus very smooth with few small punctures. Cercus length to depth ratio about 3.0 **onerosa** Uvarov (δ only).
- Narrowest part of frontal ridge well below level of most anterior part of fastigium verticis. Frons below lower ocellus with coarse punctures. Cercus length to depth ratio over 3.4 **karschi** Martinez (δ only).
- 26. Disc of pronotum conspicuously punctate behind 4th. transverse sulcus. Anterior part of fastigium verticis convex almost obsolete, filled with large shallow punctures. Inner side of posterior femora with two dark spots on upper level of inner area. Posterior tibiae always pink **karschi** Martinez (η only).
- Disc of pronotum smooth behind 4th. sulcus at least in males, though in some females seen to be very finely pitted on close examination. Inner area of posterior femora usually without spots of any kind. Separable only on δ genitalia 27.
- 27. Male penis valves flattened apically, expanded and converging above cingular valve to touch or almost touch above it on mid-line (fig. 102). Tegmina abbreviated, tapered in apical $\frac{2}{3}$, their apices falling just short of knees of folded posterior femora. Posterior tibiae deep pink. Distribution in Ethiopia and Kenya **johnstoni oresbia** subsp. nov.
- Male penis valves flattened apically but not inwardly directed so as to touch or almost touch above cingular valve 28.
- 28. Penis valves narrowed towards apex, then directed outwards and expanded at extreme tip (fig. 98). Posterior tibiae yellow or pink. Distribution Malawi and Central Tanzania uplands **laticosta** Karsch.
- Penis valves erect, not narrowed and outwardly directed apically 29.
- 29. Male penis valves broad flat with outer margin convex along its entire length (fig. 103). Visible tip of cingular valve very small. Posterior tibiae yellow or pink. Distribution in S. E. of S. Africa, Natal and Angola ... **ferriker** Walker.
- Male penis valves narrow, usually tapered apically with profile of outer margin straight or concave (fig. 101, 105). Visible portion of cingular valve larger. Hind tibiae yellow, orange, or pink. Insects with tegmina abbreviated and tapered (though in such cases apices of tegmina surpass middle of folded posterior femora) to normally developed. Distribution Malawi, Tanzania, Uganda **johnstoni johnstoni** Kirby stat. et comb. nov.

Acorypha Krauss, 1877.

Acorypha Krauss, 1877. *S. B. Akad. Wiss. Wien*, **76** (1): 38. Type for genus *Acorypha picta* Krauss, 1877. *S. B. Akad. Wiss. Wien*, **76** (1): 39, pl. 1, f. 4, 4 (A-C).

Caloptenopsis I. Bolívar, 1889. *J. Sci. Acad. Lisboa* (2), **1**: 173. Lectotype *Caloptenus vittatus* I. Bolívar, 1889 (Kirby, 1910. *A synonymic catalogue of the Orthoptera*. Vol. 3. *Orthoptera, Saltatoria*, part II. Locustidae vel Acridiidae. London). Logotype lost and of uncertain determination. Neogenerotype designated *Caloptenus nigrovariegatus* I. Bolívar, 1889. *J. Sci. Acad. Lisboa* (2): **171**. (1 ♀, Bayao, —, (Duque de Bragança) in Madrid Mus.)

Bothrocaracris Uvarov, 1953. (nom. nov. for *Bothrocaracris* Uvarov, 1950. *Eos, Madr. Tomo Extraord. Bolívar Memorial*: 404). *Ent. Ber., Amst.*, **15** (5): 146. (Type for genus 1 ♀, Brazzaville, —, (Stenstrom) in Stockholm Mus.). *Syn. nov.*

Diagnosis ♂.

1. Penis valves and aedeagus orientated in a dorso-anterior direction. Penis valves lacking lateral expansions (called 'lateral accessory processes' (Jago, 1963)) of the type seen in *Calliptamus*. Cingular valve and penis valves variable.
 - (a) If longer than penis valves then aedeagus narrow with strongly sclerotised penis valves roughly cylindrical in shape (figs. 94-96, 106; species 22, 23, 24, 25, 26), or with their posterior surfaces showing some concavity and auricularity (figs. 109-112, 115-119; species 1, 2, 5, 12, 14, 15, 16). In former case cingular valve tends to be membranous to slightly sclerotised, in latter case often markedly thickened and sclerotised. In two cases cingular valve incurled along its lateral margins to form an almost closed tube (figs. 94, 95). If cingular valve broad, flat, and laminar, with as large an exposed portion as tip of penis valves (fig. 119), then latter fairly flat and laminar (not boldly auricular and cingular valve never as large as in *Sphodromerus* spp. (fig. 93).
 - (b) If tip of cingular valve on a level with or falling short of apices of penis valves then, either cingular valve greatly reduced (figs. 100, 101, 102, 103, 105, 107, 113) or moderately reduced flat and laminar (figs. 98, 99, 108, 121, 122) with penis valves also flat and la-

minar or cingular valve thickened and sclerotised (fig. 114). If greatly reduced then penis valves short and thickly sclerotised (figs. 107, 113; species 2, 20), or rather tapered, narrow to broad and with only comparatively slight auricularity or sclerotisation (figs. 98, 99, 101, 102, 120, 121; species 3, 7-10, 11). Note in species 11 cingular valve is inclined to curl inwards along its margins. In none of these cases however do laminar lateral processes from the penis valves encircle the cingular valve dorsally (as in the 'italicus' group of *Calliptamus*) nor do the penis valves, if heavily sclerotised, have a projecting digitiform part on the mid line flanked to the outside by lateral processes, auricular or otherwise. The whole group is thus separated from the *Calliptamus* group, and on the lack of a greatly expanded cingular valves is also separated from the *Sphodromerus* group.

2. Ectophallic membrane plate never with median apical vertical knob-like sclerotisation. Generally laminar and concave dorsally, with a narrow laminar median posterior tip.
3. Cercus bilobed apically. Often rather short and deep with a small tooth bearing lobe. Never with tendency to have trilobed apex (figs. 41-66).
4. Posterior tibial spurs showing tendency to elongation and modification. Such modification starts with outermost of inner pair of spurs (always longest spur in all *Calliptaminae*) and spreads to innermost spur of outer pair. The outermost spur of the outer pair is not affected by this modification process. All stages in this development can be seen in the range of species studied. A spur starts by developing tough setae and then elongates. Setae are developed most thickly on the anterior apical edge of the spur. As elongation precedes this area expands into a lobe which eventually protudes beyond the posteriorly directed spur tip (fig. 6). Such modification of the spurs is only found elsewhere in the genus *Indomerus*.
5. Pronotal carinae distinct but showing considerable variation in orientation. Disc of pronotum smooth to moderately so. Two extremes occur. In one lateral carinae converge forward uniformly from just posterior to just anterior to their point of contact with posterior transverse sulcus. In the other case the lateral pronotal carinae are parallel to slightly divergent anterior to 2nd. transverse sulcus, sharply convergent from just posterior to forth

transverse sulcus and subparallel posterior to this (fig. 83; species 5).

6. Fastigium verticis consists of two areas, an anterior ovoid or parallel sided depression or groove, posterior to which is a parallel sided depression divided medially by a carinula. Two main trends can be seen:

- (a) narrowing and deepening of anterior depression accompanied by its forward orientation and reduction of posterior area (fig. 25; species 21). Carried to an extreme this would give a fastigium like that in *Calliptamus* species.
- (b) a broadening of anterior part accompanied by its becoming more shallow. Its orientation becomes more horizontal and posterior area more impressed. At its most extreme form we get the *corallipes* type (fig. 15). See figs. 15-40 for full range of fastigium verticis types.

♀. As in *Calliptamus*, females are extremely difficult to define generically. The females of many species however have the modified spurs typical of many members of the genus. Pronotal facies are also the same. Generic diagnosis must however be based mainly on male characteristics.

For full differentiation of all genera in *Calliptaminae* see key p. 401.

Discussion.

The reasons for synonymy of *Caloptenopsis* and *Bothrocaracris* are outlined under the general discussion (p. 399). Among problems raised however was the designation of a generotype for *Caloptenopsis*. The lectotype, *Caloptenus vittatus* I. Bolívar, 1889, has been lost, but can be easily replaced by *Caloptenus nigrovariegatus* I. Bolívar, 1889, described concurrently in the same paper. The description of the female type of *vittatus* is unfortunately not adequate enough to allow us to identify it among any other species subsequently described. *C. nigrovariegatus* is therefore here designated as a neogenerotype.

After an extensive search of the relevant collections it is clear that the following types have also been lost:

1. *Caloptenus concisa* Walker, 1870. *Cat. Derm. Salt. Coll. B. M.*, part IV: 684, 687. (Type ♀. E. Africa, Zayla. British Museum).

2. *Caloptenus signata* Walker, 1870. Ibid: 684, 687 (Type ♀ Sudan, Suakin. British Museum).

The descriptions of the above are unfortunately useless as diagnostic accounts so that they cannot be identified with certainty. This is especially so as they are females in which diagnostic characters are in any case generally difficult to find.

The following was not available for study:

Euryphymus nodulus Giglio-Tos, 1907. *Boll. Mus. Zool. Anat. comp. Torino*, 22, no. 554: 26. (Type ♀. Somalia, Mogadisciu. Turin Mus.). A photograph of the back end of the female type was supplied. As far as is known only four species of *Acorypha* live in the area. It is confirmed as an *Acorypha* species by Uvarov, 1954, who was apparently able to examine the type. It is discoloured through being in alcohol; and is also extremely brachypterous, with 'elytra narrowed to the apex'. Of the four species known from the area (*glaucopsis*, *pulla*, *ornatipes*, and *nodula* only the last named is brachypterous. The measurements given by Giglio-Tos fit the size of the material available to me.

SYNONYMIC LIST AND DISCUSSION OF SPECIES.

1. *Acorypha glaucopsis* (Walker, 1870).

- Holotype ♀. *Caloptenus glaucopsis* Walker, 1870. *Cat. Spec. Derm. Salt. Coll. B. M.*, part IV: 702. (India, N. Hindustan, (—). British Museum).
- Synonymy: *Caloptenus liturifer* Walker, 1870. *Cat. Spec. Derm. Salt. Coll. B. M.*, part IV: 703 (Syntypes 2 ♀♀. Both S. India, (—). British Museum).
- Caloptenus crassiusculus* Martinez, 1898. *Act. Soc. esp. Hist. nat.*, 27: 11 (Holotype ♂. India Or. —, (P. Castets). Madrid Museum).
- Caloptenus orientalis* Schulthess, 1898. *Ann. Mus. Stor. nat. Genova* (2), 19: 195 (Holotype ♀. Somalia, Obbia. Pavia Mus.).
- Calliptamus pachypus* Krauss, 1902. *Anz. Akad. Wiss. Wien*, 39: 57. (Holotype ♀. Socotra. Vienna Mus.) *Syn. nov.*
- Calliptamus meruensis* Sjostedt, 1909. *Wissenschaftliche Ergebnisse der Schwedischen Zool. Expd. nach dem Kilimandjaro, dem Meru und dem umgebenen Masaisteppeen deutsch-Ostafrika*, 1905-1906. 17. Orthoptera. 7. Acridoidea: 185, 192, pl. 7, f. 16. (Holotype ♀. Meru, Nieder, 27. xii. —, (—). Stockholm Mus.).
- Caloptenopsis voltaensis* Sjostedt, 1931. *Ark. Zool.*, 23A (17): 34 (Ho-

holotype ♂. Ob. Volta, Pundu, —, (Olsufiew). Stockholm Mus.). *Syn. nov.*

Acorypha bifida Chopard, 1941. *Ann. Soc. ent. Fr.*, **110**: 50, fig. 17. (Holotype ♂. Niger, env. Agadés, xi. 1938, (—). Paris Mus.) *Syn. nov.*

Caloptenopsis glaucopsis collina Uvarov, 1950. *Eos, Madr., Tomo extraord. Bolívar Memorial*: 387, 294. (Holotype ♀. Baltistan, —, (—). British Museum).

Caloptenopsis glaucopsis sudanensis Uvarov, 1950. Data as *collina* but: 388, 394. (Holotype ♂. Sudan, Wadi al Meia, 22. x. 32, (R. C. M. Darling); Paratype ♀. Sudan, Um Darag, 25. viii. 32 (R. C. M. Darling). British Mus.).

Discussion.

This species has the greatest east-west distribution of any species in the genus (fig. 14). It seems to inhabit the Sudan savannah zone in West Africa. The genitalia are uniform throughout but colour variation in the hind femora and tibia very variable (see fig. 124). These differences in leg colour have been the basis of subspecific taxa but it is preferred here, as in my treatment of *Calliptamus*, to confer such status only on those units which show subspecific discontinuity in phallic morphology. Thus using femoral and tibial colour criteria makes subspecific definition, especially in north-east Africa and the Arabian peninsula, quite impossible. In Tanzania and in Mali and Senegal facies are more stable but are clinal in nature. Subdivision serves little useful purpose at present. Later cytogenetic analysis might reveal useful diagnostic criteria, possibly in chromosome morphology. The clines in pigment development (red and black) are indicated on the map as well as areas where populations are wholly yellow. The colour key for femoral pigmentation is self explanatory.

In India the species is smaller with a tendency to brachypterous facies. This is not without parallel in *Calliptamus* where *C. wattenwylanus* and *C. subalpinus* offer similar examples. Brachypterous facies are characteristic of many montane species. In this case we might postulate a time when the eastern populations were isolated in the high uplands of India by extreme desert conditions in the lower plains. Brachypterous facies would be selected for. Expansion with amelioration of conditions would allow populations in the Middle East to meet these populations once again. Inter breeding would be reestablished, a

condition opposite to that in *C. subalpinus* where the isolated alpine form derived from *C. barbarus* did not breed with the latter when the range of the two again overlapped (see Jago, 1963, p. 327 onwards to 332).

In the collections of the British Museum were specimens labelled *Caloptenopsis glaucopsis somaliensis* Uvarov. A label indicates holo-

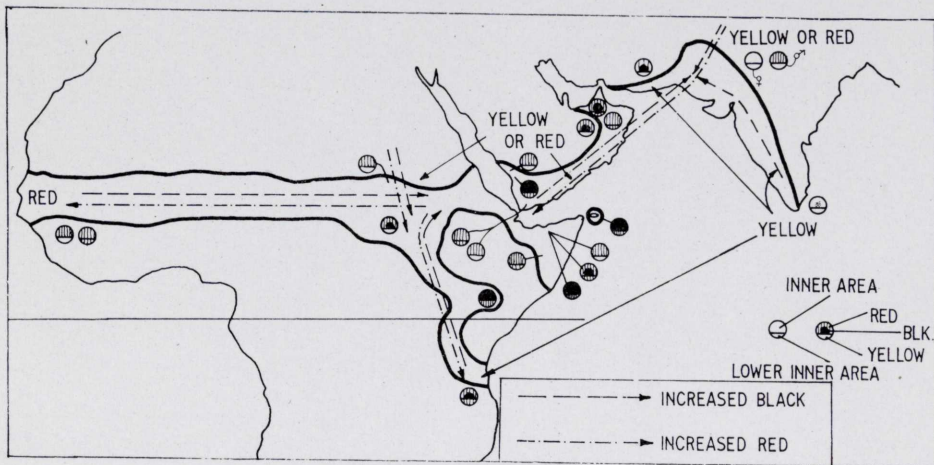


Fig. 123.—Distribution map of femoral colour forms in *A. glaucopsis*.

type, ♂, British Somaliland, Los Anod, 16.x.1935 (E. Peck). This name does not however seem to have been published.

Acorypha glaucopsis has genitalia (fig. 117) and other features (figs. 35, 61, 87) indicating closest affinity with species 2, 5, 12, 14, 15, 17 (see table 2).

Material Examined.

INDIA: 1 ♀, N. Hindustan, —, (—) (holotype *Caloptenus glaucopsis* Walker, 1970); 2 ♀ ♀, S. India —, (—) (syntypes *Caloptenus liturifer* Walker, 1870); 1 ♀, 'Baltistan', —, (holotype *Caloptenopsis glaucopsis collina* Uvarov); 2 ♂ ♂, 4 ♀ ♀, 'Baltistan', —, (Lefroy) (paratypes of last subsp.); 20 ♂ ♂, 10 ♀ ♀, Kerala state, Coimbatore, Madukarai, iv, (B. M. — C. M. Expdn. to S. India); 10 ♂ ♂, 9 ♀ ♀, Madras state, Tirunelveli, iii and ix, (B. M. — C. M. Expdn. to S. India); 10 ♂ ♂, 8 ♀ ♀, Madras state, Madwai distr., Alagar Kovil, iii, (—); 1 ♂, 2 ♀ ♀, Madras state, Cape Comorin,

30 ft., ix, (—); 1 ♀, Rajasthan state, Bikamer, xi, (Uvarov); 1 ♂, Punjab state, Delhi, at light, vii, (Kerr); 1 ♀, Maharashtra state, Ahmadnagar, x, (—); 1 ♀, Rajasthan state, Sardashahr, nr. Behari, x, (Fieldman); 1 ♂, 2 ♀ ♀, Mysore state, Mysore, iv (T. V. R.); 1 ♂, 4 ♀ ♀, Himachal Pradesh state, Simla hills, 5-7000 ft., —, (Jones); 2 ♀ ♀, Himachal Pradesh state, Simla hills, 3500-5500 ft., xi-xii, (Jones); 1 ♀, Jodhpur state, Sbec, ii, (Bhatia); 1 ♂, 1 ♀, Ind. Or., —, (P. Castets) (♂ type *Caloptenus crassiusculus* Martinez).

W. PAKISTAN: 4 ♂ ♂, 5 ♀ ♀, Salt Range, ix-x, (Hora & Pruthi); 1 ♀, Karachi, X —, (—); 1 ♂, Tel Muck, Pasai, Camman, N, (A. L. R. E.); 2 ♀ ♀, Shahrig, vii, (Sharif); 1 ♀, Ormara, v, (K. R. K.); 1 ♀, Ormara, iv, (Sharif).

IRAN: 2 ♂ ♂, 1 ♀, Kuh-i-Ginau, 20 mls. N. of Bandar Abbās, iv, (Popov); 1 ♂, Bandar-e Lengeh, Marbagh plain, iv, (Popov); 1 ♂, 1 ♀, Bandar Abbās, v, (Fassihi); 1 ♀, nr. Kerman, v, (Popov).

SAUDI ARABIA: 4 ♂ ♂, 1 ♀, Wadi Harub, 17°15' N, 42°45' E, 1000 ft., xii, (Popov); 2 ♂ ♂, 4 ♀ ♀, Wadi Harub, 25 mls. N. E. of Sabiya, xii, (Popov); 1 ♂, 1 ♀, Wadi Harub, 17°10' N, 42°50' E, xii, (Popov); 1 ♂ Asir Harub, 32 mls. N. E. of Sabiya, x, (Popov); 1 ♂, Asir, Wadi Hali, 18°45' N, 41°55' E, 1000 ft., i, (Popov); 1 ♀, Ardha, 17°03' N, 43°03' E, xi, (Popov); 1 ♀, Asir, Jaheri, 16°52' N, 43°08' E, xi, (Popov); 1 ♀, Asir, Knowa, 16°50' N, 43°12' E, xi, (Popov); 2 ♂ ♂, 2 ♀ ♀, Aanuna, v, (Popov); 2 ♂ ♂, Asir distr., Qoz Belair, 19°00' N, 41°10' E, (Fitzgerald); 10 ♀ ♀, Jebel Qarra, 2000 ft., iii and x, (Thesiger); 1 ♀, Asir distr., Shaira, 19°27' N, 41°6' E, i, (Townsend); 2 ♂ ♂, 7 ♀ ♀, Saudi Arabian desert, —, (Thomas).

MUSCAT & OMAN: 4 ♂ ♂, 5 ♀ ♀, Dhofar, Salala, ix-x, (Fitzgerald); 3 ♂ ♂, 2 ♀ ♀, Sahannot, ix, (Fitzgerald); 1 ♀, Dhofar, Arzat, ix, (Fitzgerald); 1 ♀, Dhofar, Taqa, x, (Fitzgerald); 5 ♂ ♂, 10 ♀ ♀, Salala, x, (Thesiger); 3 ♀ ♀, Salala, vii, (Popov); 2 ♂ ♂, 3 ♀ ♀, Ras al Khaima, v, (Popov); 1 ♂, 3 ♀ ♀, Huweilat, Wadi Ghaur, ii, (Guichard); 2 ♀ ♀, Sharjah, v, (Popov).

TRUCIAL OMAN: 1 ♀, El Kharran, ii, (Guichard).

BAHRAIN I: 1 ♀, Manāmah, v, (Popov).

SOCOTRA I: 1 ♀, ii-1899, (O. Simony) (holotype *Calliptamus pachypus* Krauss); 3 ♂ ♂, 7 ♀ ♀, Sl. 106?, —, (—); 1 ♂, 1 ♀, Ras Kanna, N. coastal plain, xi, (Stainer); 5 ♂ ♂, 4 ♀ ♀, Homhil, ii, (Popov); 1 ♂, 3 ♀ ♀, Hadibo, i, (Popov); 2 ♂ ♂, 2 ♀ ♀, Kalansiya, ii,

(Popov); 1 ♀, —, —, (Oxf. Univ. Expdn., 1956); 2 ♀ ♀, Hadibo, viii, (Oxf. Univ. Exp., 1956).

YEMEN: 4 ♂ ♂, 6 ♀ ♀. Usaifira, 1 ml. N. of Ta'izz, arr. 4500 ft., xii, (Scott & Britton); 1 ♀, Wadi Sheriya, trib. of Wadi Jaira, 4000 ft., viii, (Waterston); 1 ♀, Ta'izz, lower slopes of Jebel Sabir, 4600 ft., (Scott & Britton).

ADEN PROT.: WESTERN; 5 ♂ ♂, Dahala, x, (Darling); 3 ♂ ♂, 16 ♀ ♀, Dhala, 4800 ft., ix and xi, (Scott & Britton); 3 ♂ ♂, 3 ♀ ♀, Wadi Dareija, S. W. of Dhala, 4500 ft., xi, (Scott & Britton); 1 ♂, 3 ♀ ♀, Wadi Tibau, N. W. of Jebel Jihaf, 3800 ft., x, (Scott & Britton).

FRENCH SOMALILAND: 1 ♀, lava fields, 30-50 mls. S. of Djibouti, i, (Popov).

SOMALI REP.: 1 ♂, base of Erigavo scarp, 2500 ft., i, (Popov & Greathead); 5 ♂ ♂, 9 ♀ ♀, Bok, nr. Shah Libah, x, (Peck); 2 ♂ ♂, 19 ♀ ♀, Las Anod, i, viii, and x, (—); 3 ♂ ♂, 5 ♀ ♀, Tug Wajali, Hargeisa distr., viii, (Peck); 2 ♀ ♀, S. of Buramo, viii, (Peck); 2 ♀ ♀, Faroweina, 9°40' N, 43°40' E, i, (Wood); 1 ♂, Hargeisa, Tug Wajale, vi, (Uvarov).

ETHIOPIA: 8 ♂ ♂, 5 ♀ ♀, Dire Dawa, xii-iii, (Uhlenhuth).

TANZANIA: 1 ♀, Meru, 27.xii. —, (—), (type of *Calliptamus meruensis* Sjostedt); 11 ♂ ♂, 10 ♀ ♀, Lake prov., Old Shinyanga, ii-iv, (Burt); 4 ♂ ♂, 3 ♀ ♀, Central prov., Singida, v, (Burt); 2 ♂ ♂, 1 ♀, Tanga prov., Mkomasi statn., 60 mls. W. of Amani, semi desert, vi, (Burt); 5 ♂ ♂, 10 ♀ ♀, Eastern prov., Morogoro distr., i, ii, iv-vi, x, (Phipps); 2 ♂ ♂, Tanga prov., nr. Usambara Mts., Mombo plain, iii, (Uvarov); 3 ♂ ♂, Nyegezi, x, (Miller); 1 ♂, 11 ♀ ♀, Central prov., Dodoma distr., iv, (Miller); 1 ♀, Eastern prov., Kilosa, iv, (Miller); 1 ♀ Central prov., Dodoma, Kitope, iv, (Miller).

KENYA: 1 ♀, Southern prov., Oligosailie Mt., 01°33'S, 36°21'E, iii (Waloff); 1 ♀, Northern prov., Turkana hills N. of Lodwar, v, (Popov); 1 ♀, Northern prov., Mt. Kulal, 02°38'N, 36°55'E, 5500-6500 ft., x, (Williams); 1 ♀, Southern prov., Magadi, v, (Buxton).

SUDAN: 1 ♂, Blue Nile prov., Ghadam Pabya, 35 mls. W. of Gedaref, ix, (Joyce); 2 ♂ ♂, 2 ♀ ♀, Darfur prov., Jebel Terga, iv, (Darling); 2 ♂ ♂, Darfur prov., nr. Nuab, ix, (Darling); 2 ♂ ♂, Darfur prov., Jebel Engad, ix, (Darling).

MALI: 1 ♂, Middle Niger, viii, (Lean); 1 ♂, 1 ♀, bred in laboratory, labelled as *C. voltaensis* by Dirsh, 1956; 1 ♀, Macina reg., Dioura,

xi, (Davey); 32 ♂♂, 10 ♀♀, Sangha area, viii and xii, (Jago); 1 ♂, 1 ♀, 2 mls. E. of Bandiagara, viii, (Jago); 2 ♂♂, 1 ♀, S. of Mopti, Togo-Safara rd., viii, (Jago); 5 ♂♂, 1 ♀, Hombori, viii, (Jago); 1 ♂, 1 ♀, 45 km. E. of Douentza, viii, (Jago).

SENEGAL: 7 ♂♂, 4 ♀♀, Bambey, xi-xii, (Risbec).

UPPER VOLTA: 1 ♀, Pundu, —, (Olsufiew) (type *Caloptenopsis voltaensis* Sjostedt; 1 ♂, allotype, same data).

NIGERIA: 1 ♀, Northern reg., Ngala S. of L. Chad, x, (Gwynn).

NIGER: 1 ♂, nr. Agadès, xi. 1938, (—) (type *Acorypha bifida* Chopard).

2. *Acorypha pulla* (Uvarov, 1950) comb. nov.

Holotype ♂. *Caloptenopsis pulla* Uvarov, 1950. *Eos Madr., Tomo extraord., Bolívar Memorial*: 388, 396 (British Somaliland, Hargeisa, Tug Wajali, 2. viii. 1935, (E. F. Peck). British Museum).

Synonymy: *Caloptenopsis somalica* Kevan, 1961. *Beitr. Ent.*, **11** (3,4): 381-384, figs. 5-6. Holotype ♂, Kenya, Wajir distr., War Olia, 02°20' N, 40°33' E, 24.v.1947 (D. K. Kevan). British Museum). *Syn. nov.*

Discussion.

This variable little species is generally characterised by the inner side of the posterior femur being pink and the posterior tibiae the same colour. The inner area may then bear a diffuse brown spot, three separate black spots, or black pigmentation more extensively developed with above spots enlarged so that posterior pair fuse and occupy posterior third of inner area, or be completely immaculate. 'Marginellus' forms are common so that the range of variants is very similar to those well known in *Calliptamus barbarus* (Costa).

Genitalia (fig. 113) and phenetic affinities show strong relationship to species 5, 12, 14, 15, 17, and 1 (see table 2 and figs. 109-118).

Its distribution (fig. 14), in northern Kenya, Ethiopia, and Somalia probably indicates a local evolution in North East Africa. Its various colour forms and size variants hardly justify erection of subspecies since in all cases the genitalia are the same.

Material Studied.

SOMALI REP.: 1 ♂, Hargeisa, 09°33'N, 44°03'E, ii, (Wood); 1 ♀, Hargeisa, xii, (—); 2 ♀ ♀, Horo Hadle, 09°52'N, 44°02'E, i, (Wood); 1 ♀, Laferung, iii, (Guichard); 1 ♀, Duduboh, iv, (Guichard); 1 ♀, Mogadishu, vi, (Uvarov); 1 ♀, 47 mls. from Los Anod, ix, (Waloff); 1 ♂, Hargeisa, Tug Wajali, 2.viii.1935, (E. F. Peck) (holotype of *pulla*); 11 ♀ ♀, same data, (paratypes *pulla*); 1 ♀, Somaliland, 1906-4, (G. W. Bury) (paratype of *pulla*); 3 ♀ ♀, Miller field, Isha Baidoa, 4.xii.46, (D. K. Kevan) (paratypes *A. somalica* Kevan); 5 ♂ ♂, 7 ♀ ♀, Borama distr., 43°20'E, 9°55'N, 5000 ft., xii, (Taylor); 2 ♂ ♂, 1 ♀, Borama, 5000 ft., vi, (Popov); 1 ♀, Borama, xi, (Waloff); 3 ♀ ♀, Upper Sheikh, i, (Waloff); 3 ♀ ♀, Sheikh, 5000 ft., x-xi, (Guichard); 1 ♂, Hargeisa locust camp, vi, (Popov); 2 ♂ ♂, 4 ♀ ♀, Hargeisa locust camp, x, (Guichard).

ETHIOPIA: 2 ♀ ♀, nr. Argheile, 1000 ft., 05°10'N, 42°05'E, thorn bush, 2.vi.1947, (D. K. Kevan); 1 ♂, 1 ♀, El Carre, 3000 ft., 05°51'N, 42°06'E, scrub, 4.vi.1947, (D. K. Kevan) (paratypes *A. somalica* Kevan); 1 ♂, 2 ♀ ♀, Hara Digit, (Dik), vii, (Stephenson); 2 ♀ ♀, Aware, 08°15'N, 44°10'E, vii, (Stephenson); 4 ♂ ♂, 4 ♀ ♀, Dire Dawa, vi, (Uvarov); 1 ♀, Dire Dawa, vii, (Uhlenhuth); 1 ♀, Gabredarre to Dagabou, 08°05'N, 43°30'E, vii, (Stephenson); 5 ♂ ♂, 5 ♀ ♀, nr. Meis-so statn., ix, (Guichard).

KENYA: 1 ♀, Marsabit distr., Kaisut desert, scrub nr. Italisiruwa, 01°55'N, 37°30'E, 8.vi.1946 (D. K. Kevan); 1 ♀, same data; 1 ♀, Marsabit distr., Sandaslo pass, 10.vi.46, (D. K. Kevan); 1 ♀, Samburu distr., vi, 1944, (E. Opiko); 1 ♂, Wajir distr., War olia, 02°20'N, 40°33'E, 24.v.1947, (Dr. K. Kevan) (holotype *A. somalica* Kevan); 2 ♀ ♀, same data, (paratypes *somalica*); 1 ♀, Mandera distr., Damas-sa, 19.xii.44, (D. K. Kevan) (paratype *A. somalica*); 1 ♂, Marsabit, v, (—); 2 ♀ ♀, Chopa Gof, Marsabit, 02°25'N, 38°03'E, scrubby bushes, 29.ii.1944, (D. K. Kevan).

3. *Acorypha clara* (Walker, 1870) comb. nov.

Holotype ♀. *Caloptenus clarus* Walker, 1870. *Cat. Spec. Derm. Salt. Coll. B. M.*, part IV: 711 (No further data with type. British Museum).

Synonymy: *Calliptenus calcaratus* Stål, 1876. *K. Svenska Vetensk. Akad. Handl.*, 4 (5): 13 (Holotype ♀. Massawa. Vienna Mus. Type lost).

Discussion.

Its closest affinity is clearly with *A. insignis* with which it has, in the past, been related subspecifically. The latter is however extra African (see fig. 13 for comparison), and judging by the genitalia (fig. 121) the two species have clearly diverged considerably in isolation. It inhabits the dry Sudan savannah belt.

In general most clearly related to species 4, 11, 13, 16.

Material Examined.

CAPE VERDE I.: St. Vincent, 1896, (—).

MALI: 3 ♀ ♀, Diartoula, xi, (Davey); 2 ♀ ♀, Kara, i, (Davey); 2 ♀ ♀, Dioura, x-xi, (Davey).

GHANA: 1 ♂, Upper reg., 20 mls. W. of Bawku, E. of Gogo rd., iv, (Jago) (dry season diapause).

NIGER: 1 ♂, N. W. of Niamey, nr. Ayorou, nr. Niger R., iii, (Jago).

NIGERIA: 1 ♂, 2 ♀ ♀, Kalkala, x, (Gwynn); 1 ♂, 7 ♀ ♀, Dikwa, xii, (Johnston); 1 ♂, 1 ♀, Marte, xii, (Johnston); 1 ♂, Tilum, Rann distr., xii, (Johnston); 12 ♂ ♂, 6 ♀ ♀, Kalkala, xii, (Johnston); 1 ♀, Bodoweri, ii, (Golding).

SUDAN: 24 ♂ ♂, 38 ♀ ♀, Um Darag, iv and vi, (Darling); 9 ♂ ♂, 5 ♀ ♀, Wadi Showil, Sisa, iv and vi, (Darling); 1 ♂, 1 ♀, Upper Nile prov., Talodi, vii, (Cowland); 3 ♂ ♂, 1 ♀, Kassala prov., Gedaref, vi-vii, (Joyce); 1 ♂, Blue Nile prov., Singa, forest grass, xi, (Johnston); 1 ♂, Menagil, among dry Na'al grass, i, (Johnston); 1 ♂, 2 ♀ ♀, Khor Arbaat delta, iv-v, (Johnston); 1 ♂, Gezirat Fatima, ii, (Joyce); 1 ♀, Blue Nile prov., Wad Medani, cotton, v, (Johnston); 3 ♂ ♂, 3 ♀ ♀, Kordofan prov., El Obeid, Fasher, vii, (Johnston); 1 ♀ Khor Arbaat, ii, (Cameron).

ERITREA: 1 ♂, nr. Keren, xi, (Greathead); 1 ♀, Massawa, —, (—), (topotype of *calcaratus*).

4. *Acorypha insignis* (Walker, 1870) comb. nov.

Holotype ♀. *Caloptenus insignis* Walker, 1870. *Cat. Spec. Derm. Salt. Coll.*, part IV: 701 (Hindostan. No further data. British Museum.).
 Synonymy: *Caloptenus spissus* Walker, 1871. *Cat. Spec. Derm. Salt. Coll. B. M.*, V, suppl.: 70 (Holotype ♀. No other data. Desc. refers to a ♂, but measurements and labelled specimen refer to this ♂. British Mus.).

Caloptenopsis saussurei Martinez, 1898. *Act. Soc. esp. Hist. nat.*, 5 (2): 11.

Discussion.

Very close to species 3. See discussion p. 433. A large species, confined in India to the dry north west (fig. 13).

Material Studied.

SAUDI ARABIA: 6 ♂♂, 6 ♀♀, S. Arabian desert, —, (Thomas); 1 ♀, Arabia, —, (Thesiger).

MUSCAT & OMAN: 1 ♂, Salala, Dhofar, ix, (Fitzgerald).

INDIA: 1 ♀, Hindostan, —, (—) (holotype *C. insignis* Wlk.); 1 ♀, no data, (holotype *C. spissus* Wlk.); 1 ♀, Inde Orient, —, (—) (det. as *Caloptenus femoratus*); 1 ♀, Maharashtra prov., Satara distr., Kas, 3700 ft., iv, (—); 1 ♀, Kutch Mandri, v, (Bhatia); 1 ♂, Maharashtra prov., Satara distr., Mahabaleshwar, 4200 ft., iv, (—); 1 ♀, Punjab prov., Khewra, Salt range, ix-x, (Hora & Pruthi).

5. *Acorypha picta* Krauss, 1877.

Holotype ♂. *Acorypha picta* Krauss, 1877. For ref, see data under generotype. (Senegal, St. Louis, —. Mus. Caes. Vindobon now in Vienna Mus.).

Synonymy: *Acorypha (Caloptenopsis) houyi* Ramme, 1929. *Mitt. Zool. Mus. Berl.*, 15: 463, pl. 15, f. 3; fig. 97. (Holotype ♂. Cameroons, Gore. Berlin Mus. Type lost).

Discussion.

This fairly uniform species occupies a rather limited range (see fig. 14) and is most closely related to species 1, 2, 12, 14, 15, and 17. It displays almost no modification of the posterior tibial spurs. The penis apex and phallic complex (fig. 14), support its relation in the dendrogram (fig. 11). *A. pulla* and *A. picta* may indeed be derived from a common ancestor in the radiation of the group, the two species being isolated by the Ethiopian plateau land.

Material Examined.

SENEGAL: 1 ♂, Senegal, — 1869, (Steindachner). Lower label — 'St. Louis, Mus. Caes. Vindobon'. (holotype *A. picta* Krauss. Vienna Mus.).

MALI: 1 ♂, 1 ♀, San, vi, (Lean); 1 ♀, N. of Mopti, Korienzé, vii, (Lean?); 1 ♂, W. of Mopti, Diora, xi, (Davey); 1 ♀, N. of Diartoula, xi, (Davey).

NIGER: 5 ♀ ♀, Sessana, vii, (Risbec).

CHAD: 1 ♀, Neu Kamarun, Goré, 4.xii.1912, (Houy) (paratype *Acorypha (Caloptenopsis) houyi* Ramme).

N. NIGERIA: 1 ♀, Kalkala, i, (Golding); 1 ♂, 1 ♀, Kalkala, xii, (Gwynn); 1 ♂, Geidam, iii, (Buxton).

SUDAN: 1 ♀, Darfur prov., nr. Jaganor, viii, (Darling); 3 ♂ ♂, 8 ♀ ♀, Kordafan prov., El Obeid, vii, (Johnston); 13 ♂ ♂, 13 ♀ ♀, Um Darag, iv-vi, viii, and x, (Darling); 2 ♂ ♂, 2 ♀ ♀, nr. En Mihid, v, (Darling).

6. *Acorypha ferrifer* (Walker, 1870) comb. nov.

Holotype ♂ *Caloptenus ferrifer* Walker, 1870. *Cat. Spec. Derm. Salt. Coll. B. M.*, part IV: 690, 698. (S. Africa, no other data. British Museum).

Synonymy: *Caloptenopsis burri* Uvarov, 1950. *Eos, Madr., Tomo extraord., Bolívar Memorial*: 391, 299, 402. (Holotype ♀. Angola, Bihé distr., Cohemba, (29-31). viii. 1927, 1330 m., (M. Burr). British Museum). *Syn. nov.*

Discussion.

Clearly very closely related to *A. johnstoni* and *A. laticosta* (also species 7 and 8), the species seems to have a distinct relict distribution in southern Africa. *A. johnstoni oresbia* seems to be indicative of a northern divergence of *A. johnstoni johnstoni* in higher areas exactly equivalent to *A. ferriker* and probably indicative of an origin from *johnstoni* for the latter, (see figs. 101, 102, 103, 105). Note that taxa 6, 7, 8, 9, 10, 11, 13, 24, and 25 which seem to be related closely as a group are the most dislocated group of species (fig. 12), occurring in highland areas which still offer relatively moist cool climatic conditions and a well drained terrain. It is of interest that this group of species seems to represent, with a somewhat hazy boundary, the pluvial adapted group in the genus, where the remainder are by and large those suited to arid conditions. A parallel with the Palaearctic genus *Calliptamus* is immediately recalled to mind, suggesting that the '*italicus*' group of *Calliptamus* and the *ferriker* group of *Acorypha* have denominated the pluvial expansions of the genera, while the *glaucopsis* group of *Acorypha* and *barbarus* group of *Calliptamus* have denominated the interpluvials. It is of interest that other genera e. g. *Stobbea*, are similarly divided into species which are tolerant of moist conditions on the one side and drier conditions on the other.

Material Examined.

S. AFRICA: 1 ♂, S. Africa, —, (—) (holotype *ferriker*); 1 ♂, Pondoland, Port St. John, v, (Turner); 1 ♂, Natal, Cathedral Peak, Bergville distr., Drakensburg, arr. 6000 ft., iv, (Balfour Brown).

ANGOLA: 1 ♀, Bihé distr., Cohemba, viii, (Burr) holotype of *Caloptenopsis burri* Uvarov, 1950); 1 ♂, same data, (paratype *burri*).

7. *Acorypha hemiptera* (Uvarov, 1950) comb. nov.

Holotype ♂. *Caloptenopsis hemiptera* Uvarov, 1950. *Eos Madr.*, *Tomo extraord.*, *Bolizari Memorial*: 392, 401 (in key to spp.) (Tanganyika, Ufipa plat., 15 mls. N. of Sumbawanga, 17.vi.47, (B. P. Uvarov), British Museum).

Discussion.

For general outline see p. 436 under *ferrifer* (species 6). It is very clear that *hemiptera* represents the most northern expansion of *A. laticosta* (species 8, see fig. 12 for map). Here it seems that with the return of drier interpluvial conditions *A. hemiptera* is isolated on the plateau of the Mweru and Ufipa areas. It is a rainy season species occurring in areas where temperature at night may be very low for the tropics. For genitalia see figs. 45 and 99. The species is flightless and brachypterous, paralleling *A. nodula* in this respect.

Material Studied.

TANZANIA: Besides type, 1 ♀, Western prov., E. of Uvinza, Malagarasi, vi, (Fitzgerald); 7 ♂♂, 6 ♀♀, Ufipa, 2 mls. E. Sumbawanga, 22-29.v.66, (Jago).

ZAMBIA: 1 ♂, Mofwe Bambo, Mweru wa Ntipa, v, (Fitzgerald).

8. *Acorypha laticosta* (Karsch, 1896) comb. nov.

Lectotype ♂. *Caloptenopsis laticosta* Karsch, 1896. *Stettin. ent. Ztg.*, 57: 322 (Nyassaland, Milanji, —, (Brown). Berlin Mus.). Lectotype chosen from ♂ ♀ syntypes.

Discussion.

For general relationships see discussion under species 6. The genitalia are clearly allied to those of both *ferrifer* and *johnstoni* (see figs. 98, 103 and 105 and fig. 11 dendrogram). The distribution (fig. 12) is also highly suggestive of this.

The species shows no intermediates whatsoever in genitalia morphology to either *ferrifer* on the one hand or *johnstoni* on the other. Its erroneous synonymy with *ferrifer* was based entirely on superficial external characters..

Material Examined.

RHODESIA: 1 ♂, 1 ♀, Umtali, Vumba, v, (Mackie); 2 ♂♂, 2 ♀♀, Mashonaland, Mt. Chirinda, xi-xii, (Odendaal).

MALAWI: 7 ♂♂, 1 ♀, Zomba, 2000-3000 ft., ix, (—); 1 ♀, Mlanje, —, (Brown) (paratype of *C. ferrifer* Wlk; misdet.) (Mlanje lies arr. 40 mls. S. E. of Zomba); 1 ♂, 1 ♀, Mlanje, —, (Brown) (♂ labelled lectotype of *Caloptenopsis laticosta* Karsch).

TAMZANIA: 6 ♂♂, 3 ♀♀, Morogoro distr., Morogoro, xi, (Burt); 1 ♀, Kilimanjaro, Ngare-Nairobi, 4000-5000 ft., ii-iii, (Cooper).

9. *Acorypha johnstoni johnstoni* (Kirby, 1902) comb. et stat nov.

Lectotype ♂. *Caloptenopsis johnstoni* Kirby, 1902. *Trans. ent. Soc. Lond.*, 1902: 101 (Kenya, L. Baringo, 4000 ft., 20.xii.1899, (H. H. Johnston). British Mus.).

Synonymy: *Caloptenopsis elgonensis* Sjostedt, 1933. *Ent. Tidskr.*, 54: 216 (Holotype ♂. Elgon, 2000 m., —, (Levén). Stockholm Mus.) *Syn. nov.*

Discussion.

For general discussion of the species group to which this belongs, see p. 436 and dendrogram fig. 11. The male genitalia (figs. 72 and 101) are close to those of *laticosta* and *hemiptera*. The species displays a fair degree of rather random variation in the form of the outer flanges of the penis valves (figs. 101, 105), this becoming stabilised and accentuated in the more brachypterous upland subspecies *oresbia* subsp. nov. It is noteworthy however that the *oresbia* type of penis valve is approached most closely in specimens of the nominate subspecies from the Ufipa plateau and Tukuyu in the uplands of southern Tanzania. This is strongly suggestive of a past phase of evolution towards the *oresbia* type over the whole area when conditions were cooler and wetter, a difference preserved and accentuated in the upland populations of subsp. *oresbia*.

Synonymy of this species under *ferrifer* was made on the basis of superficial characters only and was incorrect.

For discussion on curious specimen from Madagascar see p. 446.

Material Examined.

KENYA: 1 ♂, Lake Baringo, 4000 ft., 20.xii.1899, (Johnston) (lectotype *johnstoni johnstoni*); 2 ♂♂, 3 ♀♀, same data (syntypes of original series); 2 ♂♂, 2 ♀♀, Chyulu hills, 5200-5500 ft., iv-v, (—).

UGANDA: 2 ♂♂, 3 ♀♀, Lango distr., ix, (Buxton); 2 ♂♂, Lango distr., vii, (Johnston); 2 ♀♀, Lango distr., Teriri to Dokolo, vii, seasonal swaps, (Johnston); 2 ♂♂, W. Nile distr., ix, bush-long grass, (Buxton); 12 ♂♂, 10 ♀♀, Kepeka, iii, vii-x-xi, seasonal swamps, (Johnston); 1 ♂, 5 ♀♀, Buddu, Kakute, i, (Johnston); 1 ♂, Ankole distr., Gayaza, iii, (Johnston); 1 ♂, Ankole distr., Lwasamaire, xi, (Johnston); 1 ♂, Entebbe, vii, (Gowdey); 5 ♂♂, 5 ♀♀, Ankole, Kabula, iii, (Johnston); 1 ♂, 1 ♀, Kigesi, Mabungo camp, 6000 ft., (Ford); 2 ♂♂, Lwanda, Koki, vii, (Johnston); 1 ♂, 1 ♀, Kigesi distr., xi, (Johnston); 1 ♂, Kakumko, x, (Johnston); 3 ♀♀, Kigesi, Kashenji, 7000 ft., hill scrub, xi, (Johnston); 1 ♀, Kigezi distr., Bufundi, 6-7000 ft., x, (Buxton); 1 ♀, Katwe, xi, (Buxton); 1 ♂, 1 ♀, Elgon, 2000 and 1700 m. respectively, —, (Lovén) (type and allotype *Caloptenopsis elgonensis* Sjöstedt).

TANZANIA: 23 ♂♂, 32 ♀♀, Tukuyu, 5084 ft., vii-ix, (Miller); 5 ♂♂, 6 ♀♀, Ufipa escarpment, vii, (Waloff).

10. *Acorypha johnstoni oresbia* subsp. nov.

Holotype ♂. Ethiopia, Simien camp. nr. Mecana, Abbo, 10,500 ft., 12.xii.52 (H. Scott).

Differential description.

Resembling the nominate subspecies externally but differing in the following:

- (a) Posterior tibiae always deep pink, never yellow, orange, or pink as in nominate subspecies.
- (b) Tegmina abbreviated and tapered, their apices falling short of knees of folded posterior femora. In nominate subspecies often same shape and often as abbreviated, though also often with apices

surpassing knees of posterior femora and tegmina of normal shape.

- (c) Male penis valves much broader (fig. 102), wider than in nominate subspecies (figs. 101, 105) and close to *A. ferrifer* (fig. 103). Penis valves touching on mid-line above cingular valve, in this respect differing from *ferrifer*.

Discussion.

A subspecies with clear definition based on differences in the male genitalia, this subspecies occurs over a relatively small range of distribution in eastern and northern Kenya and southern Ethiopia (fig. 12).

Material Examined. All paratypes.

ETHIOPIA: Holotype data above. 7 ♂♂, 10 ♀♀, same data as holotype; 1 ♀, Gamu Gofa prov., Dincha, 8900 ft., (22-26). x.48, (Scott); 3 ♀♀, Hawash, 4.ix.46, (Guichard).

KENYA: 1 ♀, Emali range, Sultan Hamud, 4900-5900 ft., iii, (—). Doubtfully included since no ♂♂ available.

11. *Acorypha karschi* (Martínez, 1902) comb. nov.

Holotype ♀. *Caloptenopsis karschi* Martínez, 1902. *Ann. Soc. esp. Hist. nat.*, **30**: 307. (Renamed by Martínez, 1902, since *Euryphymus calcaratus* Karsch, 1893 was nom. preocc. by *Calliptenus calcaratus* Stål, 1876 (see under *Acorypha clara* (Walker)) (Togoland, Bismarckburg. Berlin Mus. Type lost).

Discussion.

Well defined on male genitalia (figs. 64, 120) and apparently composed of a series of disjunct upland populations, or populations in areas adjacent to high ground. This suggests the relict nature of the species. It is especially common in the Togo hills and on high west African

mountains such as Nimba and the Loma Mts. Closely related to species 6, 7, 8, and 10, which have an East African distribution (see fig. 12).

Material Examined.

CONGO: 1 ♂, 3 ♀♀, Arua, dry acacia bush, iii, (Bredo); Bambesa, iii, (Bredo).

UGANDA: 1 ♂, Bulemezi, Luwero, xi, (Johnston); 1 ♂, Buruli, Nakasongola, xi, (Johnston); 1 ♀, Hoima, ii, (Johnston).

CHAD: 1 ♂, 1 ♀, Pama-Quelle, iv-v, 700 m., (Houy).

GHANA: 7 ♂♂, 2 ♀♀, Volta reg., Amedzofe, 2500 ft., i-iii, v, (Jago); 2 ♀♀, Volta reg., 1/2 ml. N. of Bame, iv, (Jago); 1 ♂, Volta reg., 6 mls. S. of Nkwanta, xii, (Jago) (not far from type locality); 1 ♀, Volta reg., Ahamansu hills, xii, (Jago); 1 ♂, Eastern reg., 3 mls. W. of Ajena, xi, (Jago).

TOGOLAND: 1 ♀, S. W. of Blitta, 3 mls. W. of Pagala statn., iii, (Jago) (on track to 'Bismarckburg').

12. *Acorypha bimaculata* (Krauss, 1902) comb. nov.

Holotype ♀. *Calliptamus bimaculatus* Krauss, 1902. *Anz. Akad. Wiss. Wien*, 39: 57. (Socotra. Vienna Mus. Type lost).

Discussion.

This species has for long seemed anomolous and many workers including Uvarov have debated its generic position in relation to the genus *Calliptamus*. It is in general very slender for the group with unusual lateral pronotal carinae which converge forwards very uniformly along their entire length, a feature typical neither for the old genus *Caloptenopsis* or *Acorypha* in its former narrower sense. The male cerci are slender and the ventral lobe well withdrawn from the tip of the upper lobe. Exactly the same trends are shown in *A. decisa*, the only representative of the genus in Madagascar. This coincidence may be interpreted in several ways:

(a) the similarites may indicate phyletic affinity.

- (b) the effects of island isolation may be to induce the slightly etiolated facies. A marked parallel is to be noted in the island derivatives of *Calliptamus barbarus* in the Canary Islands (*C. plebeius* (Wlk.)) and Madeira (*C. madeirae* Uv.), which are much more slender than any of their mainland relatives.
- (c) the selective effect of the long colonisation flight may be to leave a population with these facies, facies in some way connected with the greater flight efficiency and endurance of the original colonising genotype.

In the dendrogram of phenetic resemblance, it would seem that the first possibility is rather unlikely. Indeed *decisa* has general facies which would ally it on a superficial examination with the *johnstoni* group, though the male penis apex is strongly reminiscent not of that group but of the *pulla-picta* group. It may be that colonisation of Madagascar took place at a time when these two groups had closely similar male genitalia. Similarly, *bimaculata* has very close resemblances externally to *ornatipes* on the mainland, a species with which it seems to be phenetically fairly closely aligned.

Material Examined.

SOCOTRA I.: All coll. by G. Popov unless otherwise stated. 1 ♂, 1 ♀, Madibo plain, iv; 1 ♂, 3 ♀♀, Shoak, ii; 2 ♂♂, 1 ♀, Homhil, ii; 3 ♀♀, 3 ♂♂, btwn. R. A. F. camp and Muhullus, 3000 ft., iii; 1 ♀, Hijuana, 2500 ft., iii; 4 ♂♂, 6 ♀♀, Moahbadh plain, 20 mls. E. of Hadibo, ii; rest coll. by Oxf. Univ. Expdn. 1956; 2 ♀♀, Hadibo, viii; 1 ♂, 1 ♀, Mors, 2300 ft., viii; 2 ♀♀, —, viii, 1 ♀, Kishen 2080 t., viii.

13. *Acorypha onerosa* (Uvarov, 1950) comb. nov.

Holotype ♀. *Caloptenopsis onerosa* Uvarov, 1959. *Eos, Madr., Tomo extraord., Bolivar Memorial*: 389, 397. (Nigeria, Kerema, 17.ix.34, (A. M. Gwynn). British Museum).

Discussion.

This species was described in a key to *Caloptenopsis* species in Uvarov's paper. Its position within the enlarged *Acorypha* taxon can

now be assessed from the phenetic analysis as falling on the edge of the *ferrifer-johnstoni* group. On grounds of affinity in penis structure it is also close to species 3, 4, and 11 (fig. 119). Its distribution (fig. 13) shows that it occurs in the piedmont savannahs along the north facing slopes of the central African plateau. It probably occurs in the Darfur Highlands of western Sudan. Like its near relatives it probably depends on fairly high rainfall and cooler conditions.

Material Examined.

NIGERIA: 1 ♀, Kerema, 17.ix.1934, (Gwynn) (holotype *Caloptenopsis onerosa* Uvarov); 1 ♂, 1 ♀, Kalkala, 22.ii.1933, (Gwynn) (paratypes *onerosa*); 1 ♀, Kalkala, xii, (Johnston); 2 ♂♂, 1 ♀, Bauchi prov., Udubo, xii-ii, (Blasdale); 1 ♀, Marte, xii, (Johnston).

SUDAN: 1 ♀, Mongalla, Kho Noni, 3.ii.1932, (Johnston) (paratype *onerosa*); 7 ♀♀, Ghadambabya, 30 mls. W. of Gedaref, x, (Joyce).

UGANDA: All paratypes except last locality. 1 ♂, 7 ♀♀, Karamoja, 3.xi.1933, (Johnston); 1 ♀, Ahiak, 24.xi.1931, (Johnston); 1 ♀ Karamoja, 2.x.1933, (Johnston); 1 ♂, 1 ♀, Butiaba, xii, (Johnston).

CONGO: specimens from first two localities paratypes of *C. onerosa* Uv. 1 ♂, Katanga, Tenke, 30.vii-9.vii.1931, (Ogilvie); 3 ♀♀, Kasenyi, L. Albert, viii.1935, (Johnston); 2 ♂♂, 6 ♀♀, Mahagi Port, ix, (Johnston); 1 ♂, 2 ♀♀, Kasenyi, Petros village, viii, (Johnston); 1 ♂, 1 ♀, Gety, viii, (Johnston).

TANZANIA: 1 ♀, Seke rd., 9 mls. N. of Old Shinyanga, iv, (Burt).

14. *Acorypha ornatipes* Uvarov, 1950.

Holotype ♂. *Acorypha ornatipes* Uvarov, 1950, *Eos, Madr., Tomo Extraord., Bolívar Memorial*: 408, 409. (Tanganyika terr., Gaita statn., semi desert 50 mls. W. of Amani, 17.viii.37, (E. Burt). British Mus.).

Discussion.

The affinities of this species have already been discussed under species 12. All members of this species are rather small, slender, long-winged insects, clearly well adapted to very dry conditions. They are

unusual in having the lower outer area of the posterior femora black, though this black pigment may be reduced to a mere line (series from Haud). The male genitalia are diagnostic and peculiar in being greatly expanded ventro-laterally. It may well have been derived by isolation from *picta*.

Material Examined.

TANZANIA: 1 ♂, Gaita statn., 50 mls. W. of Amani, semi desert, 17. vii.37, (Butt) (holotype of *ornatipes*); 4 ♂♂, 5 ♀♀, same data (paratypes *ornatipes*).

KENYA: 2 ♂♂, 1 ♀, Damassa distr., 03°09' N, 41°20' E, desert grass and thorn bush, xii, (Kevan); 1 ♂, War Olia, Wajir, distr., 02°20' N, 40°33' E, v, (Kevan); 3 ♀♀, Archers post, 00°40' N, 37°40' E, 2000 ft., x, (Williams); 1 ♂, Wajir, x, (Kevan).

ETHIOPIA: 1 ♀, Gabredarre to Awarre, 06°30' N, 44°16' E, to 08°15' N, 44°10' E, vii, (Stephenson); 1 ♀, Ual Uel, xii, (Adefris Bel-lehu).

SOMALI REP.: 3 ♂♂, 3 ♀♀, Haud, 2700 ft., 45°28' E, 8°31' N, viii, IX (—); 2 ♀♀, Bohotleh, xi, (Peck); 2 ♀♀, Jire valley, iii, (Uvarov).

15. *Acorypha pallidicornis* (Stål, 1876).

Holotype ♀. *Calloptenus pallidicornis* Stål, 1876. *Öfvers. Vetensk Akad. Forh., Stockh.*, 33 (3): 43. (Damaraland, Ovambo. Stockholm Mus.).

Synonymy: *Caloptenus angusticeps* I. Bolívar, 1889: *J. Sci. Acad. Lisboa* (2) 1: 172. (Holotype ♀. Biballa, (Anchieta). Madrid Mus.).
Caloptenopsis fratercula Kirby, 1902: *Trans. ent. Soc. Lond.* 1902: III. (Syntypes ♂ ♀ Pretoria. British Museum).

Caloptenopsis uniformis Kirby, 1902: same ref. as above: 112. (Syntypes ♂, ♀. Pretoria. British Mus.).

Discussion.

A species with wide distribution in southern and eastern Africa (fig. 14), its genitalia (figs. 55, 110) and general phenetic relationships place it in close affinity with species 18 and 26, though the genitalia

are closest allied to 2, 5, 12, 14, and 17. Thus *pulla* and *pallidicornis* are closely allied on this character, the former possibly representing the northern extension of the latter (fig. 113). The two species overlap slightly but this may be secondary.

Posterior tibial colour is constant; yellow. The inner area of the posterior femur is variable in colour, the black mark on its inner side being small in Tanzanian material, large in Rhodesian and South African. Similarly the lower inner area is black in the Salisbury area, northwards and in the Zambesi valley being equipped with little black or none at all. In the Luano R. valley in N. W. Zambia, the lower inner area contains pink pigment.

Material Examined.

S. AFRICA: 9 ♂♂, 17 ♀♀, Transvaal, Pretoria, 10.iv.1918, (W. L. Distant) (syntypes *pallidicornis* Stål, 1876); 1 ♂, Cape prov., Kalahari, Kuruman, x, (Uvarov); 1 ♀, Orange Free State, Blomfontein, iv and ix, (—); 1 ♀, Natal, Weenen, iii, (Thomasset); 1 ♀, Transvaal, Pretoria, iv, (Faure); 3 ♀♀, Natal, Zululand, Nagana, —, (Curson); 1 ♂, Transvaal, Johannesburg, Bedford pk., v, (—); 1 ♀, Transvaal, Vereeniging, iv, (Burt); 1 ♂, N. Transvaal, —, (Nolti); 1 ♀, Cape Colony, —, (Bruicker); 1 ♂, Transvaal, Rustenburg, i, (—); 1 ♀, Cape prov., Fish R. valley, iv, (Greathead); 1 ♀, Transvaal, Johannesburg, x, (Burt); 1 ♀, Cape prov., Somerset East, ix, (Turner).

ANGOLA: 1 ♀, Kuvelal, vii, (—).

MALAWI: 1 ♂, Nyasa, 1891, (—); 1 ♀, —, —, (Ballard).

RHODESIA: 1 ♂, 2 ♀♀, Salisbury, v and xii, (Marshall); 1 ♂, Zambesi valley, vii, (Ramsay); 3 ♂♂, 4 ♀♀, Odzi distr., vi, x, xi, (Miller); 1 ♂, 4 ♀♀, Victoria Falls, 2990 ft., v, (Miller); 1 ♂, Salisbury, xi, (Marshall); 1 ♂, Zimbabwe, nr. Fort Victoria, ix, (Ogilvie); 5 ♀♀, Salisbury, ii-vi, (Marshall); 2 ♀♀, Umtibikwe R., 3000 ft., iii, (Miller); 2 ♂♂, 2 ♀♀, Selukwe, 4734 ft., iv, (Miller); 1 ♂, 1 ♀, Zimbabwe, 4800 ft., iv, (Miller); 1 ♂, Salisbury, 5000 ft., iii-viii, (Marshall); 3 ♀♀, Metopo hills, iv, (Ogilvie); 1 ♀, Umtali, v, (Mackie); 1 ♀, Shangani, De Beers ranch, v, (Mackie).

MOZAMBIQUE: 1 ♀, Caia, vi, (Bushby); 1 ♀, Biballa, Anchieta, —, (—) (Type *Acorypha (Caloptenus) angusticeps* (I. Bol.).

ZAMBIA: 3 ♂♂, 5 ♀♀, Luena R. valley, Chisorowe, iii-vi, (Burr);

2 ♂♂, 1 ♀, Luena valley, Kalulu, iv, (Burr); 1 ♀, Mporokoso distr., Meru wa Ntipa, vii, (—); 4 ♀♀, N. W. Rhodesia, —, (Burr).

KENYA: 1 ♀, Mombasa, —, (—).

TANZANIA: 1 ♂, Nyegezi, x, (Miller); 4 ♂♂, 6 ♀♀, Lake prov. Old Shinyanga, i, iii, v-vi, (Burt); 1 ♀, Central prov., 35 mls. S. E. of Singida, Mshughaa, vii, (—); 4 ♂♂, Singida, v, (Burt); 1 ♂, 4 ♀♀, Mshughaa, 35 mls. S. E. of Singida, xi, (—); 1 ♀, Gaita statn., 60 mls. N. E. of Amani, vii, semi desert, (Burt); 1 ♀, N. E. of Sumbawanga, Mbizi Mt., viii, (Burnett).

16. *Acorypha decisa* (Walker, 1870) comb. nov.

Holotype ♂. *Caloptenus decisa* Walker, 1870. *Cat. Spec. Derm. Salt. Coll. B. M.*, part IV: 700 (Madagascar. British Museum).

Synonymy: *Caloptenus baliensis* Brancsik, 1893. *Jh. naturw. Ver. (Mus. Ver.) Trençsin*, 15-16: 195, pl. 12, f. 5. (Holotype ♂. Madagascar. Budapest Mus. type lost.) *Syn. nov.*

Caloptenopsis madagascariensis Sjostedt, 1918. *Ark. zool.*, 12 (1): 16. (Holotype ♂. Madagascar, St. Marie, Moaroay, —, (Kandern). Cotype ♀. Madagask, Majanga, —, (Kandern). Stockholm Mus.) *Syn. nov.*

Discussion.

The above synonymy has been arrived at after examining available types and literature. The affinity of the species and facies of this island species compared with *A. bimaculata* is given under the discussion of that species. No other members of the genus are known from Madagascar apart from a very curious specimen lent by Vienna Museum. It is a female, determined by Brunner von Wattenwyl as a *Caloptenus* sp. The data reads, Tananarive, Madagascar, Sikora leg., —, 17890. The last could mean 17.viii.1890. Its measurements are head width 0.5, tegminal length 1.79, posterior femur length 1.78, total length 2.62 (measurements in cms.). It is a female, quite different from *A. decisa*.

The pronotal carinae converge more sharply anteriorly, the head is markedly narrowed above the eyes, the eyes hardly protruding. Very near to specimens of *johnstoni* from the Elgon area, it is of course possible that it has been mislabelled. Without evidence for the reverse,

however, and especially since we have only a single female specimen, it is also possible that this represents a Madagascar derivate of *A. johnstoni* occurring on the highest grassland areas of the island. It seems unlikely that it arrived by flying since it shows the brachypterous facies typical of *A. johnstoni* in Ethiopia. Its flight would be too feeble to allow such an extensive migration. Recent introduction is also a possibility, or a chance colonisation in the distant past when the *ferrifer-johnstoni* complex were all fully alate. The specimen offers plenty of problems but no answer. A mistake in labelling would offer a simple explanation.

Material Examined.

MALAGASY REP.: 1 ♂, Madagascar, —, (—) (holotype *Caloptenus decisus* Walker, 1870). All following collected by Zolotarevsky unless otherwise stated; 1 ♂, Miandrarivo, Ihosy, i; 1 ♀, Mahaso, (Ihasy), xii; 1 ♀, Andranomovo, Betioky, Tulear, v; 3 ♀ ♀, Ankidiabo, Betioky, Tulear, v; 2 ♂ ♂, 6 ♀ ♀, Manafaly reg., S. of Betioky, Ejeda, i-ii and v; 8 ♀ ♀, Marovoay, N. of Tananarive, xi; 2 ♀ ♀, Beraketra, E. of Tulear, xii; 1 ♂, Marofotolsky, Betioky, v; 2 ♂ ♂, Naiusana, Tananarive, ix; 3 ♀ ♀, Sakamena, Betioky, v; 1 ♀, Beomby, Betioky, v; 1 ♀, Ankazoado, Tulear, v; 1 ♀, Ambiatoka, Morondava, vi; 1 ♂, Tulear, Betioky, Behanha, i; 1 ♀, Tulear, Betioky, Ankierabo, v, limestone plateau; 1 ♀, Tulear, Tongobery, Andranolava, xii; 4 ♀ ♀, Tulear, Betioky, Santa, ii and v; next 4 specimens coll. by R. Beck, 2 ♂ ♂, 1 ♀, Tsiafatambo, viii; 1 ♂, Arivonimamo, vii; 1 ♂, St. Marie, Marovoay, —, (Kaudern) (Type *Caloptenopsis madagascariensis* Sj.); 1 ♀, Majanga, —, (Kaudern) (cotype *madagascariensis*).

17. *Acorypha nodula* (Giglio-Tos, 1907).

Holotype ♀. *Euryphymus nodulus* Giglio-Tos, 1907. *Boll. Mus. Zool. Anat. comp. Torino*, 22: 26 (Somali rep., Mogadisciu. Turin Mus.).

Discussion.

This species has clear affinities with 2, 5, 12, and 14. The genitalia (fig. 114) would indicate a possible origin for this species from *pulla*. This species is of interest as being the only member of the extreme xero-

phile side of the genus to have developed a high degree of brachypterygism. This has occurred in highlands on the edge of the Ethiopian plateau and in Somalia.

Material Examined.

KENYA: 1 ♂, 1 ♀, N. F. D., Moyale, vi, (D. K. Kevan).

SOMALI REP.: 1 ♂, 2 ♀♀, Gau Libeh, 5100 ft., vi, (Guichard); 1 ♀, Habaleh, 09°42' N, 44°80' E, (Weed); 1 ♀, (from photo of posterior part of abdomen only, kindly sent by Turin Mus.), Mogadisciu, (Holotype of *Euryphymus nodulus* Giglio-Tos).

18. *Acorypha brazzavillei* (Sjostedt, 1931).

Lectotype ♂. *Caloptenopsis brazzavillei* Sjostedt, 1931. *Ark. Zool.*, 22A (15): 57, pl. 6, f. 2,3, 4. (Lectotype chosen from ♂ cotype, French Congo, Brazzaville, —, (Senström) British Museum).

Discussion.

A rather uniform species, it extends zoogeographically across the high central areas of the African continent (fig. 14). Phenetically closely related to species 15 and 26. The latter, *A. divisa*, is contained within its area of distribution, and is possibly a high altitude derivative of this species. The short compact penis valves (fig. 108), are suggestive of fairly close relationship with species 19 and 20.

Material Examined.

CONGO REP.: Besides lectotype; 1 ♀, Musana, —, (Lundgren).

ANGOLA: All coll. by M. Burr unless otherwise stated. All Moxico distr.; 1 ♂, Middle Luena R., v; 1 ♂, arr. 1475 m., viii; 4 ♂♂, Va. Luso, 3000 ft., vi; 1 ♂, Sachanga R., vii; 2 ♀♀, Chimbumba R. trib. of Lumeji R., vii; 1 ♂, 2 ♀♀, Mu-Simój R., x; 1 ♀, Busaco, vi; 1 ♂, Luchase distr., Cuango R., 5000 ft., x; 4 ♂♂, 2 ♀♀, Bié-Cuando

distr., Cohemba, 1330 m., viii-ix; 3 ♂♂, 2 ♀♀, Lunda distr., ix, (Miss. Sci. Suisse, 1932-33).

TANZANIA: 1 ♂, 1 ♀, Tanga prov., Mombo, Muwera, vii, (—); 2 ♀♀, Tabora distr., Kalula, viii and ix, (Miller); 1 ♂, 1 ♀, Singida prov., Mshughaa, 35 mls. S. E. of Singida, xii, (Burt); 1 ♂, 1 ♀, Kahama prov., Ushirombo rd., 57 mls. W. of Kahama, vii, (—); 3 ♂♂, 6 ♀♀, Kahama prov., Mkwemi, 22 mls. W. of Kahama, ix, xii-ii, (Burt); 2 ♀♀, Kahama prov., Ushirombo rd., 16 mls. W. of Kahama, xii, (Burt); 1 ♀, Lake prov., Old Shinyanga, v, (Burt); 1 ♂, 1 ♀, Kahama prov., 30 mls. N. of Kahama, Itimbia, vi, (Burt).

19. *Acorypha modesta* Uvarov, 1950.

Holotype ♂. *Acorypha modesta* Uvarov, 1950. *Eos Madr., Tomo extraord., Bolivar Memorial*: 409, 412. N. Nigeria, Azare, v. 24, (Dr. Ll. Lloyd). Brit. Mus.).

Discussion.

The phenetic affinity (fig. 11) and genitalia (fig. 106) indicate a close connection with *A. dipelecia* (see also distribution fig. 13) and *A. brazzavillei*. This species is one of those which occupies an awkward intermediate position taxonomically between the *nigrovariegata-ferrifer* complex and the *pulla-picta* group (see also table 2, p. 408).

A. dipelecia Jago, recently described, is the species which has most often been given the erroneous name '*modesta*'. The two species are close in external facies.

Material Examined.

NIGERIA: 1 ♂, Northern, Azare, v, (Lloyd) (holotype *modesta*) all rest paratypes of same species unless otherwise stated. 9 ♂♂, 5 ♀♀, same data as holotype; 1 ♂, Northern, Azare, Gadau, v, (Lloyd); 1 ♀, Northern, Sherifuri, nr. Azare, —, (Hannington); 1 ♂, Northern, Azare, vi, (Lloyd); 2 ♀♀, Northern, Bauchi, v, (—); 1 ♂, 1 ♀, Yanda, v, (—).

SUDAN: All paratypes of *modesta*. 1 ♀, Opau, iv, (Johnston); 1 ♂, 1 ♀, Basnada, xi, (Richards).

SUDAN: All paratypes of *modesta* except Moroto and Ama material. 1 ♀, Moroto, vii, (Buxton); 3 ♂♂, 4 ♀♀, Kibale, Bugwere, x, (Johnston); 4 ♂♂, 1 ♀ (Adacha), i, (Johnston); 2 ♂♂, 3 ♀♀, Soroti, i and xi, (Johnston); 3 ♀♀, Toro-Mbale rd., xi, (Johnston); 1 ♂, Pallisa, xii, (Gowdey), 1 ♂, 1 ♀, Mbale, xii, (Serastopulo); 1 ♂, 2 ♀♀; Arua, iii, (Bredo).

KENYA: 1 ♀, L. Rudolf, Central I., —, (Worthington).

20. *Acorypha dipelecia* Jago, 1966.

Holotype ♂. *Acorypha dipelecia* Jago. *Eos. Madr.*, **41** (2-3): 345-349, figs. 10-12, 14-17 (Ghana, Northern reg., 2 mls. S. of Masaka, 30.xii.59, (Jago). Brit. Mus.)

Discussion.

The phenetic affinity of this species (fig. 11) indicates a position peripheral to the *pulla-picta* group but intermediate between that complex and the *ferrifer* group (see also table 2, p. 407). The species has well developed tibial spurs, highly modified to life on loose gravels. It is xerophilous and does not inhabit montane grassland in Ghana like its more widespread sympatric, though distant relative, *A. unicarinata*.

Material Examined.

SENEGAL: 1 ♀, Dakar, viii, (Viullet) (previously in paratype series of *A. modesta* Uv.).

GHANA. All paratypes of *A. dipelecia*. All coll. by N. D. Jago. Besides holotype; 5 ♂♂, 3 ♀♀, Northern reg., 2 mls. S. of Masaka, xii; 3 ♂♂, Northern reg., N. of Yendi, iv; 1 ♂, Northern reg., 21 mls. W. of Busunu, Sawla-Tamale rd., iv; 1 ♀, Upper reg, 10 mls. E. of Tumu, iv; 3 ♂♂, 1 ♀, Upper reg., 10 mls. E. of Han, iv; 2 ♂♂, 3 ♀♀, 5 mls. E. of Han, iv; 1 ♂, 20 mls. W. of Bawku, hills E. of Gogo rd., iv; 2 ♂♂, 2 ♀♀, Volta reg., Keti Krachi R. Ho., xii; 1 ♂, Volta reg., 35 mls. S. of Keti Krachi, iv; 1 ♂, 1 ♀, Eastern reg., 5 mls. S. of Oyibi, Tema-Adome rd., iv; 4 ♂♂, 9 ♀♀, Northern reg., 4 mls. N. of Mole R., Busunu-Doboye rd., xii.

UPPER VOLTA: 1 ♂, 1 ♀, 2 mls. N. E. of Kantchari, iii, (Jago).

NIGERIA: 1 ♂, 3 ♀♀, Bauchi prov., Udubo, river flood plain, xii-ii, (Blasdale); 1 ♂, Bauchi, v, (—) (previously in paratype series of *A. modesta* Uvarov).

21. *Acorypha pipinna* sp. nov.

Holotype ♂. (Angola, Ovamboland, Oshikango, arr. 4700 ft., 2. vi. 54, (J. Malfour Brown) (British Mus.).

Differential description.

Male. Fastigium verticis, narrow, deep and anteriorly orientated (fig. 25) with very small portion posterior to arcuate transverse groove. Pronotum (fig. 77) with lateral carinae smoothly convergent anterior to posterior transverse sulcus. Prosternal tubercle broadly transverse, concave behind and swollen laterally. Tegminal apices surpassing tips of folded posterior femora; hind wings colourless. Posterior femora deep (length to depth ratio 2.7) reminiscent of *A. glaucopsis*. Outer area and lower outer area white with light brown 'herring bone' pattern. Knee lunules light brown, edged with black. Inner and lower inner areas black. Upper surface of femur with two pale transverse brown fascia. Posterior tibiae pale straw yellow; eight inner and seven outer spines black tipped. Cerci rather short and broad (fig. 51). Penis valves (fig. 109) showing marked affinity with *pallidicornis* (fig. 110) but differing from its nearest relative in having auricular side folds obscuring deeper median parts of penis valves when viewed from behind.

Females. In general facies like male. The two paratypes display a 'marginellus' form and a peculiar dark brown form with pale grey upper surface to tegmina. Similar colour forms occur in *A. unicarinata*.

Measurements. Besides measurements listed in table 1, p. 406 the following are useful (all measurements in mm.):

	Male (Type)		Females (Paratypes)
Head width	0.36	:	(2) 0.44, 0.43
Femur length	1.06	:	(2) 1.99, 1.99
Tegminal length	1.44	:	(2) 2.06, 2.07
Total length	1.93	:	(2) 2.72, 2.72

Material Examined.

Besides holotype the following paratypes.

SOUTH WEST AFRICA: 1 ♀, Damaraland, about 5 mls. W. of Grootfontein, 4900 ft., 26.v.54, under stones and dung, (J. Balfour-Brown); 1 ♀, Damaraland, about 4 mls. N. E. of Grootfontein, Tigerquelle farm, arr. 4800 ft., 25.v.54, along track through bush, (J. Balfour Brown). Paratypes in British Mus., London.

22. *Acorypha unicarinata* (Krauss, 1877) comb. nov.

Type ♀. *Caloptenus unicarinatus* Krauss, 1877. *S. B. Akad. Wiss. Wien*, **76** (1): 37 (Senegal, 1879, (Steindachner). Vienna Mus.).

Synonymy: *Euryphymus marginipennis* Karsch, 1893. *Berl. ent. Z.*, **38**: 103, 104. (Type ♀. Togoland, Bismarckburg, i. 1891, (—). Berlin Mus.) *Syn. nov.*

Discussion.

Phenetically (fig. 11) this species lies very near to *nigrovariegata*. The genitalia (fig. 95) clearly place it near to the aberrant *corallipes* (species 25). An unusual feature of this species is the unique anterior median tooth of the supra-anal plate.

The species *marginipennis* seems to be an upland, more darkly pigmented form of the lowland type. This colour variant has identical genitalia and intergrades without a break into lowland savannah type. A common and widespread species in the Guinea savannah belt from Uganda to Sierra Leone (fig. 13).

Material Examined.

SENEGAL: 1 ♀, no other data, (Steindachner) (Type *Caloptenus unicarinatus* Kr.).

SIERRA LEONE: 3 ♀ ♀, S. W. prov., Mt. Aureol, 1000 ft., iii,v,xi, (Phipps); 1 ♂, Sonkonja, v, (Simpson); 1 ♀, Northern prov., Kabala, Kondambaia, i, (Phipps).

GHANA: 1 ♂, Ashanti reg., Amantin, ii, (Simpson). All rest of material coll. N. D. Jago. 3 ♂♂, 1 ♀, Upper reg., 10 mls. E. of Han, iv; 2 ♂♂, 1 ♀, Upper reg., 5 mls. E. of Han iv; 2 ♂♂, Upper reg., N. of Nakpanduri, Gambaga scarp, iv; 1 ♂, 1 ♀, Northern reg., Chana-Chuchilaga rd., iv; 1 ♂, 2 ♀♀, Northern reg., 2 mls. N. of Yendi, iv; 1 ♂, 1 ♀, Northern reg., 6 mls. N. of Pongeri, Sawla-Wa rd., iv; 3 ♂♂, Northern reg., 21 mls. W. of Busunu, Sawla-Tamale rd., iv; 3 ♀♀, Ashanti reg., Ejura scarp, iv; 1 ♂, Volta reg., Amedzofe, i; 1 ♂, 1 ♀, N. E. of Ketu Krachi, 1 1/2 mls. along Chiare to Chiringa path, v; 1 ♂, Volta reg., 1/2 ml. N. of Bame, iv; 2 ♂♂, Volta reg., 35 mls. S. of Ketu Krachi, iv; 3 ♂♂, 1 ♀, Volta reg., Nkwanta-Chiare, 3 mls. W. of Chiare, xii; 2 ♂♂, 2 ♀♀, Volta reg., 0°39' E, 8°17' N, 2 mls. E. of Chiare, xii, (not far from 'Bismarckburg'); 5 ♂♂, Volta reg., 2 mls. N. E. of Chiare, xii; 2 ♂♂, 2 ♀♀, Volta reg., ml. 4, Nkwanta-Ahamansu rd., xii; 1 ♂, 1 ♀, Volta reg., 1 ml. W. of Chiare, xii; 1 ♀, Volta reg., 1/2 ml. E. of Ketu Krachi, ii; 6 ♂♂, 2 ♀♀, Northern reg., 4-6 1/2 mls. N. of Mole R., Busunu-Daboye rd., xii; 2 ♀♀, Northern reg., Damongo game res., nr. Lovi camp, iv; 1 (nymph), Northern reg., 1 ml. E. of Damongo, i.

TOGO: 1 ♀, Misahohe, xii, (Baumann) (Cotype *Euryphymus marginipennis* Karsch); 1 ♀, Bismarckburg, i, (—) (cotype of *E. marginipennis*).

MALI: 1 ♀, Medina, —, (Davey).

NIGERIA: 1 ♀, Northern prov., Zaria, iv-v, (Golding).

SUDAN: 2 ♀♀, Equatoria prov., Loka, iv, (Johnston); 1 ♂, Imatong Mts., 5000 ft., xi, (Steele).

UGANDA: 1 ♀, Malala R., ii, (Hopkins); 1 ♂, Buganda prov., Kiboga, iii, (Hancock); 1 ♂, Acholi prov., Amar Gulu, xi, (Johnston); 1 ♂, 1 ♀, W. Nile prov., Arua, iii, (Bredo).

23A. *Acorypha nigrovariegata nigrovariegata* (I. Bolívar, 1889)
stat. et comb. nov.

Holotype ♀. *Caloptenus nigro-variegatus* I. Bolívar, 1889. *J. Sci. Acad. Lisboa* (2), 1: 171 (Angola, Bayao, Duque de Bragança. Madrid Mus.).

Synonymy: *Caloptenopsis congoensis* Sjostedt, 1931. *Ark. Zool.*, 22, A (15): 54, pl. 5, f. 7; pl. 6, f. 5 (Allotype ♂. French Congo, Musana,

—, (M. Lundgren). Stockholm Mus. Holotype ♀, same data and depository) *Syn. nov.*

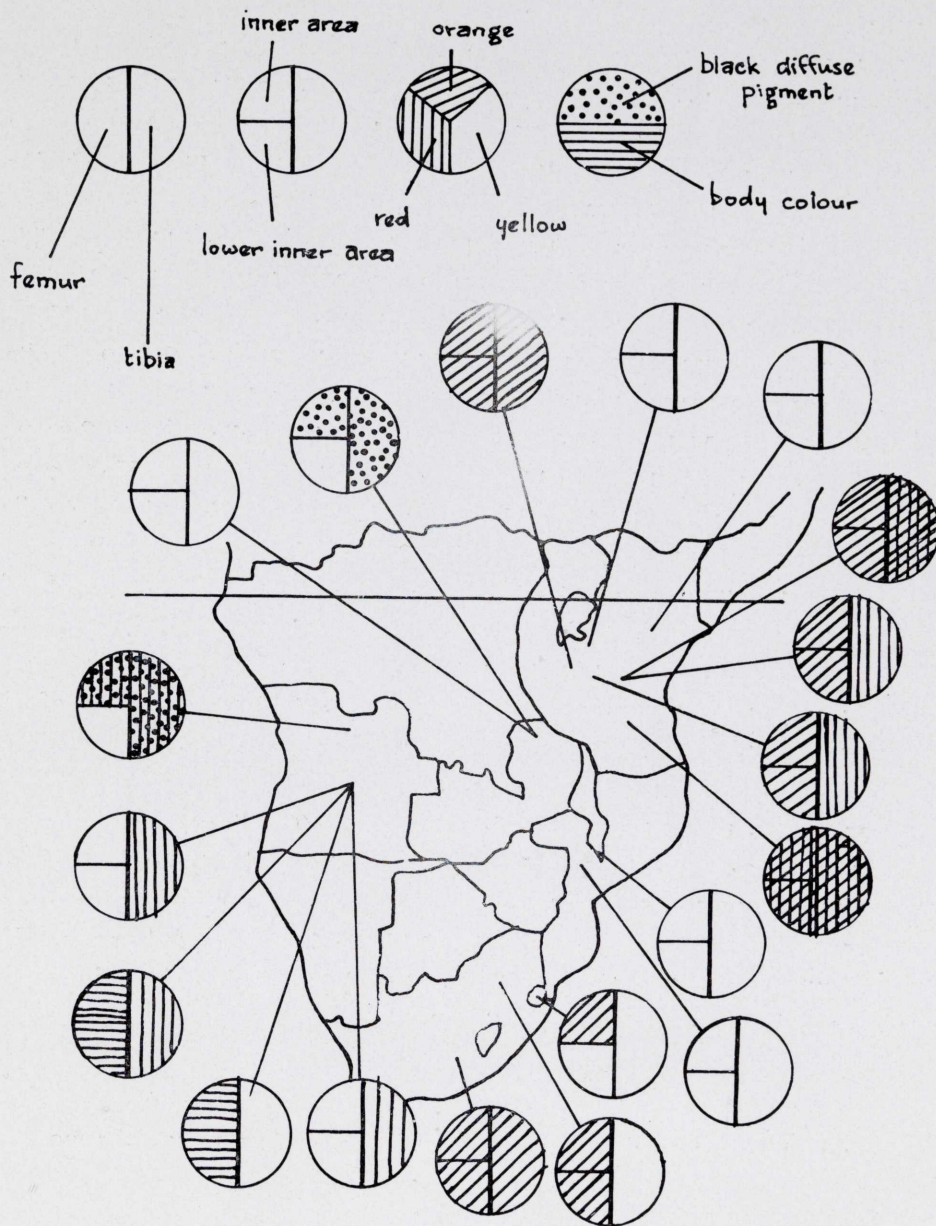


Fig. 124.—Distribution map of femoral colour forms in *A. nigrovariegata*.

Caloptenopsis ruginota Uvarov, 1950. *Eos, Madr., Tomo Extraord., Bolivian Memorial*: 390, 398, 401. (Holotype ♀. Angola, Moxico distr., Langiliko R., 24. vi. 27, (M. Burr). British Mus.). *Syn. nov.*

Discussion.

The species *nigrovariegata* can be easily defined on the form of the male genitalia. The nominate subspecies has penis valves of the form shown in fig. 96, clearly different from those of subsp. *tibialis*. The nominate subspecies is distributed in the west of the species range, subsp. *tibialis* in the larger eastern part of the range. Intermediate types occur in the area northern Zambia and south western Tanzania (fig. 13). Male penis morphology shows that this species is near to species 22 and 25 on one hand, and 24 and 26 on the other (see key to species, p. 421). The two subspecies may be separated as follows:

nigrovariegata nigrovariegata (Western subsp.)

1. Anterior ovoid depression of fastigium verticis same width in ♂♂ as first antennal segment.
2. Penis valves (fig. 96) splayed outwards. Cingular valve tip level with or falling short of penis valve apices. Heavily sclerotised basal 5/6 of penis valves elongate or shortened and conspicuously narrowed apically.
3. Hind tibiae pink or yellow; inner side of posterior femur body colour or yellow (see fig. 124).

nigrovariegata tibialis (Eastern subsp.)

This depression narrower than width of first antennal segment in ♂♂.

Penis valves touching on mid-line even if outsplayed externally (fig. 97). Cingular valve apex extending well beyond tips of penis valves. In Angola basal part of penis valves still elongate as in *tibialis*. In 'congoensis' type shortened and parallel sided without pre-apical constriction.

Hind tibiae and inner area of femur yellow in north and south-east of range, orange or red in central area, orange in south.

Material Examined.

ANGOLA: Besides ♀ holotype; 1 ♀, Moxico distr., Langiliko R., 24.vi.27, (M. Burr) (holotype *Caloptenopsis ruginota* Uv.); 2 ♀♀,

same data, (paratypes *ruginota*); 1 ♂, Moxico distr., Munhang R., vii, (Burr); 2 ♂ ♂, 1 ♀, Luchase distr., Cuango R., 5000 ft., x, (Burr) (last from specimens paratypes *ruginota*); 1 ♂, 1 ♀, Moxico distr., Va. Luso, 3000 ft., vi, (Burr); 1 ♂, Lingue Bungu R., x, (Burr); 2 ♂ ♂, 2 ♀ ♀, Moxico distr., Mu Simoj R. valley, x, (Burr); 1 ♂, 1 ♀, Chimbumba R., tributary of Lumeji R., —, (Burr); 2 ♂ ♂, 2 ♀ ♀, Moxico distr., Upper Luena R., Katula village, v. (Burr); 1 ♀, Moxico distr., Munhang R., viii, (Burr); 2 ♀ ♀, Moxico distr., Loangenda R., Va. Luso-Cameia rd., v and vi, (Burr).

CONGO: 1 ♀, Katanga prov., Lubudi R., xi, (Burr).

CONGO REP.: 1 ♂, 2 ♀ ♀, Musana, —, (M. Lundgren) (Allotype and 'types' *Caloptenopsis congoensis* Sj.).

23B. *Acorypha nigrovariegata tibialis* (Kirby, 1902)

comb. et stat nov.

Holotype ♀. *Calliptamus tibialis* (Kirby, 1902. *Trans. ent. Soc. Lond.* 1902: 110, 241. (Transvaal. British Museum).

Synonymy: *Caloptenus mossambicus* Brancsik, 1893. *Jh. naturw. Ver. (Mus. Ver.) Trencsin*, 15-16: 194, pl. 12, f. 4. (Types ♂ ♀. Mozambique. Budapest Mus. Types lost). *Syn. nov.*

Caloptenopsis angusticosta Karsch, 1896. *Stett. ent. Ztg.*, 57: 321, fig. 37. (Lectotype ♂. Nyasaland, Milanji, —, (Brown, V). Berlin Mus.) *Syn. nov.*

Caloptenopsis femoralis Kirby, 1902. *Ann. Mag. nat. Hist.*, (7), 10: 241 (Holotype ♀. Transvaal, Pretoria, British Mus.) *Syn. nov.*

Caloptenopsis speciosa Sjostedt, 1909. *Wissenschaftliche Ergebnisse der Schwedischen Zool. Exped. nach dem Kilimanjaro, dem Meru und den Umgebenden Masaisteppeen deutsch-Ostafrikas, 1905-1906*. 17. Orthoptera. 7, Acridoidea: 185, 193, pl. E, f. 17. (Holotype ♂. Kilimandjaro, Kibonoto, 29.ix.1905-6, (Sjostedt). Paratype ♀. Meru, Nieder, Ngare na nyuki, —, i. —, (Sjostedt). Both Stockholm Mus.) *Syn. nov.*

Caloptenus v. plagiatus Brunner, 1910. *Reise in Ostafrika in den Jahren 1903-1905*, 2: 642, pl. 27, f. 16. (Type ♀. Manda I., (Voeltzkow). Berlin Mus.) *Syn. nov.*

Discussion.

This eastern subspecies bears the name of *tibialis*, a species newly synonymised with *nigrovariegata*. The other synonyms are erected on

the basis of examination of the types or examination of original descriptions. Uvarov had already (1922) synonymised *mossambicus* and *angusticosta*. Type material of the latter has been examined and found to be synonymous with *nigrovariegata*.

For the basic differentiation of the two subspecies in *nigrovariegata* see discussion under nominate subspecies.

Material Examined.

KENYA: 2 ♂♂, 5 ♀♀, Manchako distr., Emali range, Sultan Hamud, 4900-5900 ft., iii, (—); 1 ♀, Turkana distr., Mt Kulal, 02°35' N, 36°55' E, 5900-6500 ft., x, (Williams).

TANZANIA: 1 ♂, Kilimandjaro, Kibonoto, 29.ix.1905-6, (Stapp) (type *C. speciosa* Sj.); 1 ♀, Ngare na Lyuki, Meru, i, (Sjostedt) (cotype of *C. speciosa* Sj.); 1 ♀, Manda I., —, (Voeltzkow) (Type. *Caloptenus v. plagiatu*s Brunner); 11 ♂♂, 10 ♀♀, Old Shinyanga, ii-iv, (Burt); 1 ♂, 1 ♀, Mkwemi, 22 mls. W. of Kahama, xii-ii, (Burt); 2 ♀♀, Morogoro distr., Morogoro forest, ii, (Phipps); 1 ♂, 1 ♀, Mpwapwa, Mt. Wilkins, 6000 ft., xi, (Burt); 2 ♂♂, Kikori, 50 mls. N. of Kondoa Irangi, x, (Burt); 5 ♂♂, 4 ♀♀, Mshughaa, 35 mls. S. E. of Singida, xi, (Burt); 1 ♂, 1 ♀, Tubugwe, x, (Miller); 2 ♀♀, Kilosa, i, (Miller); 1 ♂, 1 ♀, Kikori, 50 mls. N. of Kondoa Irangi, i, (Bush); 1 ♀, Korogwe, xi, (Miller); 1 ♀, Ngomeni, Mingano, i, (Phipps); 1 ♀, Pemba I., —, (—) (paratype *Calliptamus tibialis* Kirby, 1902).

MALAWI: 1 ♂, 1 ♀, Milanji, v. (Brown) (♂ lectotype of *Caloptenopsis angusticosta* Karsch); 3 ♂♂, 8 ♀♀, Zomba, —, (Breese); 1 ♀, Zomba, ii-iii, (—); 1 ♂, Zomba, —, (Lennon).

SWAZILAND PROT.: 2 ♂♂, 2 ♀♀, Swaziland, xi, (Burt); 2 ♂♂, 4 ♀♀, Mbabane, x, (Burt).

RHODESIA: 1 ♂, Mashonaland, Mt. Chirinda, 3800 ft., ii, (Swynerton); 1 ♂, Odzi distr., xi, (Miller); 2 ♀♀, Mashonaland, Odzi distr., v-vii, (Miller); 1 ♂, Mashonaland, Chirinda forest, i, (Marshall); 1 ♀, Mashonaland, Mt. Chirinda, iii, (Odendaal).

S. AFRICA: 9 ♀♀, Transvaal, Pretoria, —, (Distant) (syntypes *Calliptamus tibialis* Kirby, 1902); 1 ♂, same data, (lectotype *C. tibialis* Kirby); 2 ♂♂, Transvaal, 15 mls. N. E. of Johannesburg, v, (Burt); 1 ♂, Transvaal, Johannesburg, Bedford Park, v, (Butt); 1 ♂, Trans-

vaal, N. of Nelspruit, x, (Ogilvie); 1 ♂, Transvaal, Johannesburg, iv, (Balinsky); 1 ♂, Transvaal, Pretoria, iv, (Faure); 1 ♀, Transvaal, Zeerust, Morico, ii, (Faure); 2 ♀ ♀, Transvaal, Johannesburg, x, (Balinsky); 1 ♀, Caps prov., Mafeking, ii, (Faure); 1 ♀, Zululand prov., Nagana, —, (Curson).

24. *Acorypha recta* Uvarov, 1950.

Holotype ♂. *Acorypha recta* Uvarov, 1950. *Eos, Madr., Tomo Extraord., Bolívar Memorial*: 408, 410. (Angola, Moxico distr., Mu Simoj R. valley, 25.x.27, (M. Burr). British Mus).

Discussion.

Confined to the northern uplands of central Angola (fig. 12), this species is phenetically related to the *ferrifer-johnstoni* group, (fig. 11). This is supported by the form of the male genitalia (fig. 104), which indicate some affinity also with *divisa* and hence to the *nigrovariegata* group, (see fig. 96).

Material Examined.

ANGOLA: Besides holotype; 1 ♂, same data as above (paratype *A. recta*); 1 ♂, Luchase distr., Cuango R., 5000 ft., x, (Burr) (paratype *A. recta*).

25. *Acorypha corallipes* (Sjostedt, 1931) comb. nov.

Type ♀. *Caloptenopsis corallipes* Sjostedt, 1931. *Ark. Zool.* **22**, A (15): 57, pl. 6, f. 1. (French Congo, Brazzaville, —, (Stenström). Stockholm Mus.).

Synonymy: *Bothrocara bolivari* Uvarov, 1950, *Eos, Madr., Tomo Extraord., Bolívar Memorial*: 404-406. (Holotype ♂. E. Angola, Moxico distr., Busaco, 23.vi.27, (M. Burr). British Mus.). *Syn. nov.*

Discussion.

The background to the above synonymy is outlined in the general introduction to this paper. The phenetic affinity of this species indicates

that it is an aberrant species allied to the *ferrifer-johnstoni* group. On genitalia alone (fig. 94) it would seem closely allied to *A. unicarinata* (fig. 95).

Material Examined.

CONGO REP.: Holotype *corallipes* Sj. Data as above.

ANGOLA: 1 ♂, Moxico distr., Busaco, vi, (Burr) (Type *Bothrocarracris bolivari* Uv.); 2 ♂ ♂, 1 ♀, paratypes with same data. All following material paratypes of *B. bolivari* Uv. unless otherwise stated; all coll. by M. Burr, 2 ♂ ♂, Moxico distr., Upper Lumeji, vi; 2 ♂ ♂, 2 ♀ ♀, Moxico distr., Luena falls, v; 2 ♀ ♀, (1 nymph), Moxico distr., Upper Chonga R., v; 2 ♀ ♀, Moxico distr., Lungue Bungo R., x; 3 ♀ ♀, Moxico distr., Chimbumba R., trib. of R. Lumeji R., vii; 1 ♀, Moxico distr., Luena R., v; 1 ♂, Luchase distr., Makontolo R., x.

26. *Acorypha divisa* (Uvarov, 1950) comb. nov.

Holotype ♀. *Caloptenopsis divisa* Uvarov, 1950. *Eos, Madr., Tomo Extraord., Bolívar Memorial*: 391, 400, 403. (Angola, Bihé distr., Cohemba, 20.viii.27, 1330 m., (M. Burr). British Mus.).

Synonymy: *Acorypha sinuata* Uvarov, 1950. Ibid: 409, 411. (Holotype ♂, Tanganyika, Bukeni, 26.x.1926, (N. C. E. Miller). British Mus.). *Syn nov.*

Discussion.

This species not only displays close affinity to *A. nigrovariegata* in the form of the male penis (fig. 100), but also phenetically falls into a peripheral position on the *pulla-picta* complex. It therefore offers intermediate facies (figs. 11, 24, 50, and 76). The new synonymy is clearly evident after an examination of the genitalia. Note that the species appears to have a discontinuous distribution in East Africa and Angola (fig. 14). This may very easily be due to incomplete collecting. Since however it seems to be an inhabitant of the highest ground in Angola this may be another distribution of great zoogeographical interest as being a result of interpluvial climatic conditions.

Material Examined.

TANZANIA: 1 ♂, Bukene, x, (Miller) (holotype *A. sinuata*); 5 ♂♂, 4 ♀♀, same data (paratypes *A. sinuata*); next 13 specimens paratypes *A. sinuata*, 8 ♂♂, Iambi, 20 mls. S. E. of Mkalama, vi, (Burt); 5 ♂♂, Mschughaa, 35 mls. S. E. of Singida, xi, (Burt); 1 ♂, Mkwami, Kahama, ix, (Burt); 1 ♂, 1 ♀, Mshughaa, Singida, vii, (—); 1 ♀, Tabora, xii, (—).

ZAMBIA: 1 ♀, Abercorn, viii, (Burnett).

ANGOLA: All paratype material of *Caloptenopsis divisa* Uv. Besides holotype. 2 ♂♂, 3 ♀♀, same data; 1 ♂, Bihé distr. Cohemba, ix, (Burr); 1 ♀, Moxico distr., 1476 m., viii, (Burr); 1 ♀, Moxico distr., Va. Luso, xi, (Burr).

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